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Insights into Decision-Making on Natural Health Products and Factors for Natural Health Product Consumption

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Summary

Natural health products (NHP) are important in many healthcare systems. They are a popular option of complementary and alternative medicine, especially for non-fatal health issues such as mild to moderate respiratory diseases (RD) or regarding concentration and cognition (CC). Most NHP are available over the counter and require no prescription. Thus, their usage requires active decision-making by the consumer for the preferred option. However, limited knowledge exists about the cognitive process of NHP decision-making, especially regarding consumers' association chains from choice relevant NHP attributes to abstract life-guiding values. Furthermore, little is known about the individual and health behavioural factors, that explain NHP usage in the German population, about potential differences between NHP user groups, and about which value orientations impact NHP usage. Addressing these research gaps with a quantitative and qualitative research approach, this thesis provides insights into NHP usage, especially regarding RD and CC indications, and into the cognitive process involved in NHP decision-making.

The online survey of this thesis, with a sample representative for the German population (n=1707), found that most NHP users took NHP in self-medication and sought information about the NHP on-product or from pharmacists. The first study focused on individual and health behavioural factors of RD-NHP users, setting them in comparison to other NHP and those who have never or have not used NHP in the past 12 months (non-NHP user) and applied a multinomial logistic regression model. Results showed that vaccination-related behaviour was not a predictor for RD-NHP usage. Other factors like employment and consulting pharmacist for non-fatal health issues predicted RD-NHP usage. The second study focused on NHPCC users in differentiation to other NHP users and NHP users, whose last NHP consumption was more than 12 months ago (past NHP user). Using two binomial logistic regression models allowed to determine predisposing, enabling, need and health service use (HSU) factors regarding NHP usage that indicate usage of NHP for CC (NHPCC). Especially enabling (health professionals, literature and journals as NHP information sources) and HSU factors (health support or illness prevention as NHP usage aims) predicted NHPCC usage.

Overall, NHP users had stronger openness-to-change value orientations than past and non-NHP users. Furthermore, RD-NHP and NHPCC users had significantly stronger self-transcendence values than past/non-NHP users. To discover the cognitive process involved in NHP decision-making, 26 in-depth laddering interviews with NHP consumers were conducted using the means-end-chain approach. The resulting hierarchical value map visualized main association chains, reaching from choice relevant NHP attributes via associated consequences up to linked life-guiding values. Security and the self-transcendent orientated values of self-direction and stimulation were associated with trust and conscious decision-making, which was further linked to the attributes of effectiveness, tolerance and

declaration. Universalism or benevolence, both openness-to-change orientated values, guided attention on the attributes of sustainability and regionality.

The insights of this work contribute to a better understanding of NHP usage and NHP decision-making in Germany. Health professionals and policy makers should be aware of the factors that indicate NHP usage and consider them in the development and optimization of healthcare strategies. The results can contribute to characterizing the target group of related campaigns, especially regarding RD and CC. Future research is needed to create such knowledge for other NHP indication fields. Furthermore, this thesis provides insights into the cognitive process and the values involved in NHP decision-making, by examining the association chains between values and NHP attributes. NHP manufacturers can use such information for the development of consumer-centric product concepts and communication strategies. Using these insights in the right manner can facilitate safer and more conscious decision-making for NHP, which could help to reduce the burden of health facilities regarding non-fatal health issues due to the widespread self-medication manner.

Zusammenfassung

Natürliche Gesundheitsprodukte (eng. Natural health products, kurz NHP) sind ein wichtiger Bestandteil vieler Gesundheitssysteme. Sie sind eine weitverbreitete Form der Komplementär- und Alternativmedizin, insbesondere genutzt für nicht lebensbedrohliche gesundheitliche Beschwerden wie zum Beispiel mild bis moderat verlaufende Atemwegserkrankungen, oder für Anliegen, welche die Kognition und Konzentrationsfähigkeit betreffen. Die meisten NHP sind freiverkäuflich und benötigen keine ärztliche Verschreibung. Ihr Erwerb und ihre Nutzung setzt in den meisten Fällen daher eine aktive Entscheidung zwischen den auf dem Markt angebotenen Optionen voraus. Bisher ist wenig über den kognitiven Prozess dieser Entscheidungsfindung, bekannt, insbesondere bezüglich der Assoziationsketten, die NHP-Nutzer*innen zwischen konkreten NHP-Attributen und ihren abstrakten Werten bilden. Des Weiteren weiß man wenig darüber, welche individuellen und mit dem Gesundheitsverhalten in Verbindung stehenden Faktoren die Nutzung von NHP in Deutschland erklären, ob sich diese zwischen verschiedenen Nutzergruppen unterscheiden und welchen Einfluss Werteorientierungen dabei haben. Die vorliegende Thesis befasst sich unter Anwendung von quantitativen und qualitativen Forschungsmethoden mit diesen Forschungslücken in Bezug auf deutsche NHP-Nutzer*innen. Ein besonderer Fokus liegt dabei auf der Nutzung von NHP für Atemwegserkrankungen sowie für die Konzentration und Kognition. Zudem gibt diese Forschungsarbeit Einblicke in den kognitiven NHP-Entscheidungsprozess von nutzenden Personen.

Die online-Studie dieser Thesis, deren Stichprobe (n=1707) für die deutsche Bevölkerung repräsentativ war, zeigte, dass die meisten NHP-nutzenden Menschen, NHP in Selbstmedikation verwenden. Informationen zu den Produkten erhielten sie über das Produkt selbst oder über Mitarbeitende in Apotheken. Die erste Studie nahm individuelle und das Gesundheitsverhalten betreffende Faktoren von NHP-Nutzer*innen für Atemwegserkrankungen in den Fokus. Sie verglich diese mit Nutzenden anderer NHP und Nicht-Nutzer*innen innerhalb der letzten 12 Monate, u.a. unter Anwendung einer multinominalen logistischen Regression. Das Ergebnis zeigt, dass kein Zusammenhang zwischen Impfverhalten und der NHP-Nutzung besteht. Andere Faktoren, wie eine berufliche Beschäftigung oder das Aufsuchen von Apotheker*innen für Beratung zu nicht lebensbedrohlichen Gesundheitsbeschwerden waren Indikatoren für die Verwendung von NHP für Atemwegserkrankungen. In der zweiten Studie ging es um die Nutzer*innen von NHP zur Unterstützung von Kognition und Konzentration (NHPCC) in Unterscheidung zu anderen NHP-Nutzer*innen innerhalb der letzten 12 Monate sowie zu NHP-Nutzer*innen, deren letzte NHP Verwendung mehr als 12 Monate zurücklag. Mit zwei binären logistischen Regressionen wurden Prädispositions-, Ermöglichungs- und Bedürfnisfaktoren sowie die Nutzung von Gesundheitsangeboten bezüglich NHP auf ihren Einfluss auf die NHPCC Nutzung untersucht. Insbesondere Ermöglichungsfaktoren (Erhalt von Informationen über

NHP von Gesundheitsfachkräften und aus Literatur und Zeitschriften), sowie NHP zu Zwecken der Gesundheitsunterstützung und Krankheitsprävention zu nutzen, waren Indikatoren für die Verwendung von NHPCC.

Insgesamt hatten alle NHP-Nutzer*innen, verglichen mit Nicht- und Vergangenheitsnutzer*innen, eine stärker ausgeprägte Werteorientierung hinsichtlich Offenheit für Veränderungen; diejenigen mit der Nutzung von NHP für Atemwegserkrankungen und Kognition und Konzentration zudem stärker hinsichtlich Selbsttranszendenz. Um Erkenntnisse zum kognitiven Prozess der Entscheidungsfindung für NHP zu erlangen, wurden 26 Tiefeninterviews durchgeführt, wie nach der Means-End-Chain Theorie empfohlen unter Anwendung der Laddering-Technik. Die resultierende Hierachical Value Map visualisiert die wichtigsten Assoziationsketten, welche von den für die Entscheidung relevanten Produktattributen über assoziierte Konsequenzen bis hin zu den übergeordneten Werten reichen. Sicherheit und die selbsttranszendent orientierten Werte Selbstbestimmung und Anregung waren mit Vertrauen und einer bewussten Konsumentscheidung verbunden, die wiederum mit Wirkung, Verträglichkeit und Deklaration in Verbindung gebracht wurden. Universalismus und Sozialität, beides orientiert zu Offenheit für Veränderung, leiteten die Aufmerksamkeit zu den Attributen Nachhaltigkeit und Regionalität.

Die Ergebnisse dieser Forschungsarbeit tragen zu einem besseren Verständnis von NHP-Nutzer*innen in Deutschland sowie deren Entscheidungsfindung bei. Gesundheitsexperten und -politiker sollten die Faktoren, welche die Nutzung natürlicher Gesundheitsprodukte beeinflussen, kennen und sie bei der Entwicklung und Optimierung von Gesundheitsstrategien berücksichtigen. Die Ergebnisse dieser Arbeit können dazu beitragen, Zielgruppen für Kampagnen solcher Strategien zu beschreiben, insbesondere hinsichtlich Atemwegserkrankungen und dem Thema Kognition und Konzentration. Weitere Forschung ist notwendig, um ein solches Wissen auch für andere Anwendungsfelder zu erlangen. Durch die Aufdeckung der Assoziationsketten zwischen Produktattributen und übergeordneten Werten konnten wertvolle Einblicke in den kognitiven Entscheidungsprozess für NHP gewonnen werden. Hersteller von natürlichen Gesundheitsprodukten können solches Wissen nutzen, um verbraucherorientierte Produktkonzepte und Kommunikationsstrategien zu entwickeln. Diese Forschungsarbeit leistet einen wichtigen Beitrag zum besseren Verständnis von NHP-Nutzer*innen und deren Entscheidungsprozess. Dieses Wissen richtig eingesetzt, kann zu einer verbesserten Informations-Kommunikation beitragen, welche die Nutzung von natürlichen Gesundheitsprodukten bewusster, sicherer und damit für das Gesundheitssystem entlastend machen kann.

Contents

List of Abbreviations

ABM	Andersen's Behavioural Model for Health Service Use
APSA	Attention and Performance Self-Assessment
CAM	Complementary and alternative medicine
CAMHM	Complementary and Alternative Medicine Healthcare Model
CC	Concentration and cognition
CM	Conventional medicine
HM	Herbal medicine
HSU	Health service use
HVM	Hierarchical value map
MEC	Means-End-Chain
NHP	Natural health product
NHPCC	Natural health product for concentration and cognition
NCCIH	National Center for Complementary and Integrative Medicine
nCC-NHP	Natural health product not for concentration and cognition
nRD-NHP	Natural health product not for respiratory diseases
OTC	Over the counter
PEN	Predisposing, enabling, and need
RD	Respiratory disease
SSVS	Short Schwartz Value Survey

List of Figures and Table

1 Introduction

Natural health products (NHP) are an important element in many healthcare systems. Their use is traditionally embedded in many cultures (Eardley et al., 2012; Paudyal et al., 2022; Thakkar et al., 2020). They are a subgroup of complementary and alternative medicine (CAM). CAM is an umbrella term that refers to therapies and health practices that are not wholly considered as a part of conventional medicine (CM) (Liu et al., 2021). While alternative therapies substitute CM, complementary therapies supplement CM. Integrative medicine combines CAM with CM (Wagner, 2021). The National Center for Complementary and Integrative Medicine (NCCIH) distinguishes between mind and body approaches, which involve physical and psychological therapies, and natural products, including nutritional inputs such as dietary supplements, vitamins and minerals, as well as botanical drugs (Still et al., 2022). Figure 1 gives an overview on what the NCCIH define as elements of complementary and integrative medicine.

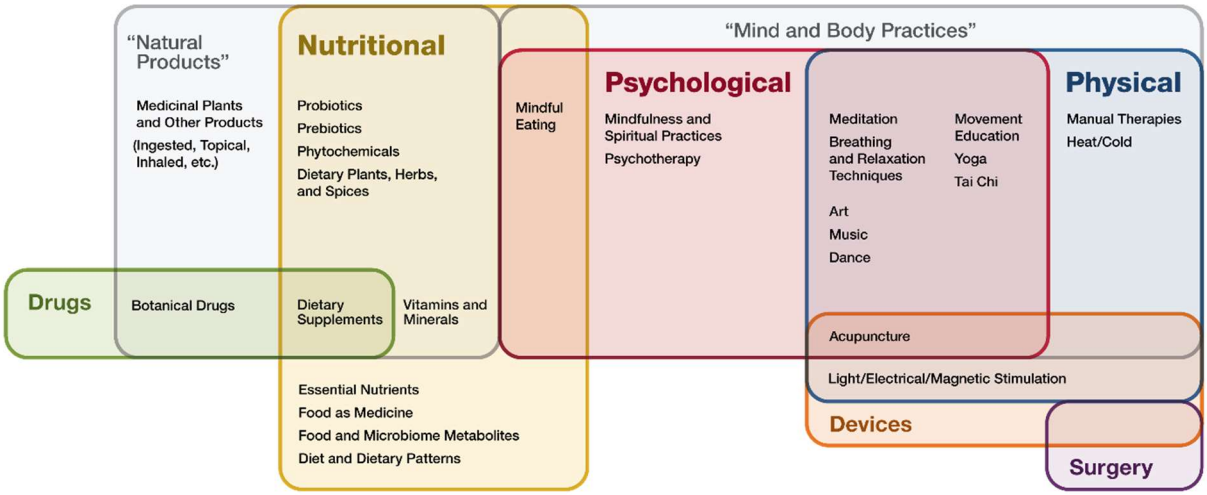

Figure 1 Scope of the NCCIH with categories and elements of complementary and integrative medicine. Source: National Center for Complementary and Integrative Health (2021, p. 15)

There is no universal definition of CAM and NHP, as the terms depend on the context of national healthcare systems (Gaboury et al., 2012). Canada is one of the only nations with an official legal definition of NHP, where NHP are defined as "*naturally occurring substances that are used to restore or maintain good health. They are often made from plants, but can also be made from animals, microorganisms and marine sources. They come in a wide variety of forms like tablets, capsules, tinctures, solutions, creams, ointments and drops*."(Government of Canada, 2016). In Germany, there is no legally official term for NHP. The three subgroups of natural products as defined by the NCCIH (botanical drugs, dietary supplements, vitamins and minerals) are governed by different legal regulations. On the superior level of the European Union, herbal medicine (HM), equating botanical drugs, is guided by the Herbal Medicinal Product Committee (HMPC). It's Directive 2001/83/EC define

HM products as "*any medicinal product, exclusively containing as active ingredients one or more herbal substances or one or more herbal preparations, or one or more such herbal substances in combination with one or more such herbal preparations*"(THE & UNION, 2004). On a national level, the German "Bundesinstitut für Arzneimittel und Medizinprodukte (BfArM)" regulates HM licensing according to the "Arzneimittelgesetz", which includes herbal, traditional, and homeopathic medicines (Bundesinstitut für Arzneimittel und Medizinprodukte, 2023). Dietary supplements are legally defined as nutrition supplements and are regulated by the "Nahrungsergänzungsmittelverordnung" (NemV) (Bundesamt für Verbraucherschutz und Lebensmittelsicherheit, 2023). In this work, NHP are defined in reference to the "natural product" category of the NCCIH, subject to the condition that they are sold and used for health issues. Thus, in this thesis the term NHP includes HM, dietary supplements and homeopathy, provided that they are based on natural ingredients.

In 2022, German pharmacies (including mail order pharmacies) sold about 162 million packages of HM and homeopathies, most of which were non-prescriptive. The overall sales volume summed up to 2.3 billion Euros, which made 29% of the total sales of non-prescriptive medicines (Bundesverband der Arzneimittel-Hersteller e.V., 2023).

Most HM packages were sold for respiratory indications, first of all cough, followed by gastrological products, sedatives and sleep aids (Bundesverband der Arzneimittel-Hersteller e.V., 2023). Figure 2 shows the sales of phytopharmaceuticals in Germany from 2015 to 2022 by their indication. While sales for most indications were relatively stable, sales for products targeting cough or other respiratory diseases decreased distinctively during the Covid-19 pandemic in 2020 and 2021. In 2022 sales in those respiratory indication fields rose again, looking at cough, even higher than before the pandemic.

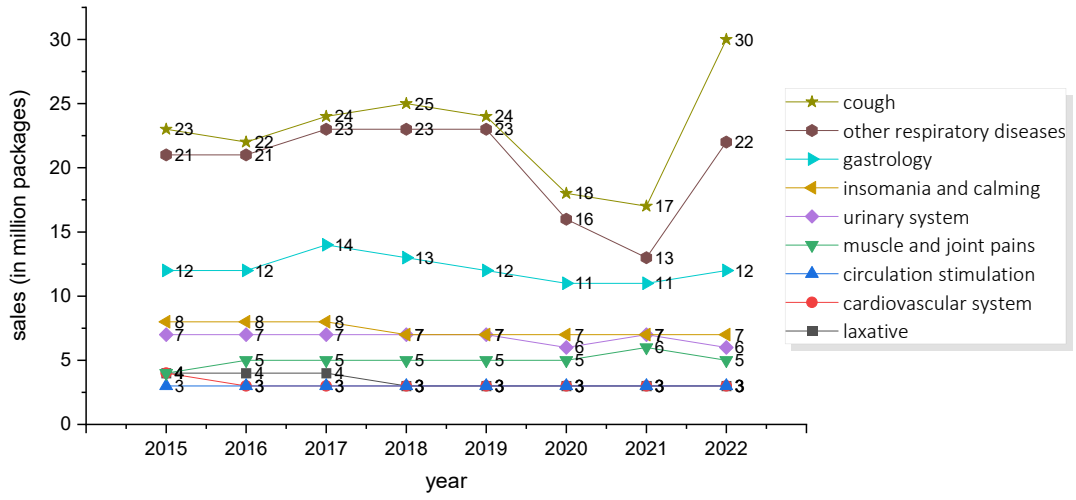

Figure 2 Sales of phytopharmaceutical products from 2015 to 2023 by indication (in million packages). Source: Bundesverband der Arzneimittel-Hersteller e.V. (2015-2023). Arzneimittelreporte für Deutschland. Own illustration

CAM applications can target the treatment of diseases and symptoms as well as illness prevention, health maintenance and support (Fouladbakhsh & Stommel, 2007; Welz et al., 2018).

Respiratory diseases (RD) are among the most circulated diseases primary medical care is dealing with (Incze et al., 2018; Jin et al., 2021). The SARS-Covid-19 pandemic evinced their challenging potential for healthcare systems around the globe (Lavine et al., 2021).

The development and validation of new CM is often laborious and lengthy. In comparison, CAM have the potential to be produced in a shorter time and get approval for human use quicker, because it underlies other legal regulations than CM (Rosales-Mendoza, 2020). In Germany, for example, CM requires drug approval with clinical studies to proof effectiveness. In contrast to CM, HM requires drug registration. Here, clinical studies for proofing effectiveness are not required, when the natural ingredients are traditionally known and used for at least 30 years, including a minimum of 15 years within the European Union (Bundesinstitut für Arzneimittel und Medizinprodukte, 2022). Popular and traditionally known plants on the ingredients lists of NHP for RD are for example thyme (Thymus vulgaris L.) and sage (Salvia officinalis) (Oriola & Oyedeji, 2022).

Besides for treating widespread infectious diseases with several prescriptive and over the counter (OTC) treatment options, NHP are popular for indications in which conventional pharmaceutical interventions cannot prove success as well as for difficult to diagnose health conditions (Kemppainen et al., 2018). This applies for example for the indication field of concentration and cognition. Dementia, a major cognitive disorder, affects more than 55 million humans globally, mainly seniors aged 65 years+. The life of these patients becomes increasingly constrained by memory loss and cognitive decline (Gauthier et al., 2021). Further, also younger and from a cognitive perspective healthy people, can struggle with their cognition and concentration abilities, for example as a result of stress, pressure and growing demands at school, university or work (Brühl & Sahakian, 2016; d'Angelo et al., 2017). For both, the market provides a wide range of NHP for concentration and cognition (NHPCC) support (Insaf et al., 2010). They include for example extracts from plants like Ginkgo biloba or Panax ginseng, which are traditionally known for indications regarding cognition (Suliman et al., 2016). The results of studies about their clinical benefit for patients with cognitive impairments is inconsistent, but studies proofed no profusion of side effects compared to placebo (Birks & Evans, 2009; Suliman et al., 2016). Recent studies investigated neuroactive potential in other plants that were previously not associated with neuro-support. Neuro-supportive potential was for example found in hops, which could result in new innovative NHPCC (Kirchinger et al., 2019; Riepl et al., 2018; Urmann et al., 2015; Wolf, Bayerl, et al., 2023; Wolf et al., 2022).

Both indications, RD and concentration and cognition (CC), have in common, that they affect people across all genders, ages and social classes. However, neither the users of NHPCC nor of RD-NHP have been further investigated in a Western European country. Many studies have focused on specific subpopulations like CAM use among African Americans (Brown et al., 2009), the Indian community in South Africa (Singh et al., 2004), or on specific CAM consumer groups such as male cancer patients (Evans et al., 2007) or type 2 diabetes patients (Tehrani et al., 2022). Blandon et al. (2008) reviewed consumer acceptance and regulatory issues on functional foods and NHP. Boon et al. (2013) examined the role of naturalness on NHP choices. More recent consumer and marketing-related research specifically on NHP usage in European countries is rare. In the previous decades, the healthcare market has been transforming rapidly, creating a need for recent research perspectives from a psychologic, economic and marketing view on consumer relevant healthcare subjects (Iacobucci, 2019). Although recent research has considered such objectives, healthcare and medical decision-making remains an understudied research field (Zhu et al., 2022).

Consumers' decision-making is a complex process, which involves several impact factors. Popular psychological decision-making models have in common that choice behaviour is related to the value that a person is placing on a specific goal and to the probability of expecting that a given action will lead to the desired goal (Maiman & Becker, 1974). Based on this assumption, the means-end-chain model provides insights to consumption-relevant cognitive structures of product or service users. It is a hierarchical model that pictures the linkages between the most relevant concrete product attributes for the user, associated consequences and abstract, in daily life mainly unconscious but life-guiding values (Grunert & Grunert, 1995). Values are beliefs and refer to desirable goals. They are closely connected to emotions, and motivate and guide action (Schwartz, 2012). Schwartz's theory of basic values includes ten core values that stand in relative importance to one another and build a hierarchy of priority. They can be categorized in four higher-order value orientations and differ based on culture. Values are an important aspect of the self and of personality. They serve as relatively stable life-guiding principles (Sagiv & Schwartz, 2022). Little data exist regarding the impact of values on health-related decision-making, especially when it is a self- rather than physician-directed decision. Some studies focused on the impact of values on specific treatment options like vaccinations, or on patients with particular diseases like cancer (Baldt, 2019) or type 2 diabetes (Lee et al., 2013), but little research has been conducted on NHP usage and users so far.

As highlighted by Chakravarti and Crabbe (2019), there is a need for valid consumer-centric perspectives in marketing research concerning healthcare subjects using different methodological approaches, particularly including qualitative methods, which are more grounded in subjective experience. The present thesis combines quantitative and qualitative research, serving this request. Its

methodological approach, which will be presented in chapter 4, is both, data-driven and consumer-centred (Singhal et al., 2020). Results are covering macro- and micro-level perspectives on NHP users, embracing personal characteristics, health behaviour and decision-making. Thereby, this thesis aimed to determine key individual and behavioural factors that explain NHP usage, inter alia for treatment and information choices – a key priority research gap, as pointed out by Zhu et al. (2022). In the quantitative approach, the main emphasis was on identifying the factors that influence RD-NHP users or NHPCC users, with a special focus on differences in the value orientations of different NHP user groups. Further, by applying qualitative research, this thesis aimed to fill the research gap concerning the cognitive process of NHP decision-making. It uncovered which values dominantly guide the NHP choice process as well as disclosed choice-relevant linkages between NHP product attributes and life guiding values. All studies were conducted in Germany, as an example for a Western European nation, from a consumer and marketing research perspective.

Results of this thesis are relevant for healthcare professionals as well as for politic and economic actors in the healthcare system. Utilization patterns impact the success of health-related products. The better a product meets values and preferences of the user, the higher the probability of a consumption according to the official consumption recommendations such as intake frequency and duration. In the context of NHP, implementing knowledge about consumers and their values in product-design can facilitate a more efficient and safer NHP usage (Drumond, 2020). The new insights about individual and health behavioural factors that explain NHP usage that this thesis provides, can be considered for the development and optimization of NHP communication and marketing strategies (Costa et al., 2004) as well as for target group definitions.

2 Theoretical background

Most NHP do not require a prescription and are available OTC. Hence, their consumption requires an active choice and decision-making by the consumer, who needs to decide between various product options (Chowdhuri & Kundu, 2020; Tsui et al., 2012; Zhu et al., 2022). Resulting, self-medication is common practice. In 2018, 92% of German HM-users took HM as self-medication. Only 38% informed their practitioner about it (Welz et al., 2019). On the one hand, self-medication holds the advantages of timely and independent self-care (Noone & Blanchette, 2018) and a disburden of the healthcare system by reducing non-mandatory practitioner visits and costs underpinned by health insurances (Bundesverband der Arzneimittel-Hersteller e.V., 2022). On the other hand, not consulting professionals and perceived high safety of NHP can lead to a wrong intake adherence and an underestimation of potential side effects (Ji et al., 2022; Tsui et al., 2012). Since the twenty-first century, the healthcare system shifted from a traditional disease-oriented towards a health and support-oriented approach, setting the focus on the patient (Frist, 2005; Zhu et al., 2022). The trend goes towards shared decision-making, where health professionals design and manage individual care plans and therapies together with the patient. Individual preferences, priorities, values and experiences are considered and impact healthcare choices (Catalyst, 2017; Zhu et al., 2022). One key to the success of such plans is an adequate utilization adherence of implemented health products. The better a product meets the individual preferences and values, the better the chances are for successful utilization adherence. Product attributes like the product design can trigger values and preferences (Drumond, 2020), as product and packaging designs, symbols, shapes and colours impact decision-making on a conscious and unconscious level (Chlupsa, 2022). For example, colour and brightness of packages can impact expectations regarding the effectiveness and the price of health products (Roullet & Droulers, 2005). However, it is not only visible attributes that influence decision-making, but also non-visual ones. Choosing NHP as a CAM treatment to CM often goes along with the association of naturalness and safety of NHP (Boon et al., 2013).

The following paragraphs present two theoretical approaches which give a framework and provide explanation to (health) decision-making. They are the basis for the present thesis. The first approach comes from a macro-perspective, using quantitative research methods, and classifies individuals into predetermined groups giving insights into overall value orientations of target segments (Reynolds & Gutman, 1988). The second approach, the Means-End-Chain model, gives a more micro-level and psychological perspective, exploiting qualitative in-depth methods, and aiming to better understand consumer motivation (Reynolds, 1985). One further paragraph will give an overview on the definition and impact of values on (health) decision-making.

2.1 The CAM Healthcare Model

The CAM Healthcare Model (CAMHM), developed by Fouladbakhsh and Strommel 2007, is a conceptual framework to guide CAM research and practice. It is based on the Andersen's Behavioural Model for Health Service Use (ABM), that has been used in studies conducted in different areas of the healthcare system, and in relation to many different kinds of diseases, as well as focused on various community groups (Babitsch et al., 2012). For example, Baker (2009) determined contextual factors, which shape perceived oral health outcomes (Baker, 2009). Shao et al. (2018) used the framework of the ABM for examining factors for health service utilization of migrants in Beijing (Shao et al., 2018). The initial ABM from the 1960s assumes that the health service use of an individual is influenced by personal and contextual parameters, categorized into predisposing, enabling and need (PEN) factors. Predisposing characteristics describe the personal disposition to use services. They include demographics, social structure and health beliefs. The latter ones, are values, attitude and knowledge about health services. Enabling factors imply organizational and financial means (for example employment and health insurance), which make the use of a health service possible and affordable. Need factors are expressed by perceived and/or evaluated exigency for care, such as the presence of symptoms or diagnosed illnesses (Andersen, 1995; Fouladbakhsh & Stommel, 2007).

Expanding on this framework, Fouladbakhsh and Strommel modified the ABM particularly for the application of CAM products and services. They extended the model by the construct of health service use (HSU) factors in order to consider not only CAM provider utilization, but also self-directed and provider-guided CAM practices as well as CAM products. The purpose and manner of CAM use were further parameters ascribed to HSU. Additionally, the CAMHM added individual and system level parameters to the PEN factors, which have the potential to identify predictors and patterns of CAM usage. These were for example the availability of CAM information and the access to health services, which were added to the enabling factors. Personal factors such as the need for control and perceptions, for example about risk, safety and efficacy of health care options, were added to the predisposing factors (Fouladbakhsh & Stommel, 2007). Figure 3 shows an overview of the CAMHM including some example elements of each factor category.

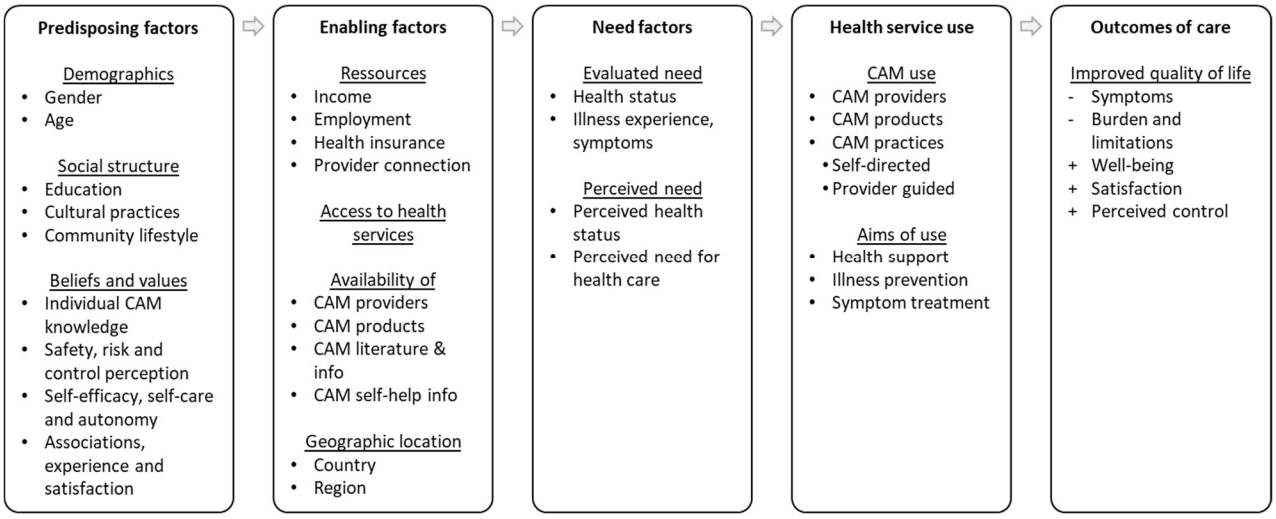

Figure 3 Overview example of the CAM Healthcare Model by Fouladbakhsh and Stommel 2007. Own illustration

Although not many studies used the CAMHM or ABM as an underlying theoretical framework, many of the examined parameters which influence CAM, NHP or HM use can be assigned to the factors of the CAMHM. These studies found contradictory results for example concerning predisposing and enabling factors. While some of these studies found no significant association between CAM use and gender, age or education (Ennis, 2014), other studies found the parameters of being female (Adib-Hajbaghery et al., 2021; Dehghan et al., 2022; Frass et al., 2012; Kemppainen et al., 2018), middle-aged (Frass et al., 2012), and having higher levels of education (Adib-Hajbaghery et al., 2021; Frass et al., 2012; Kemppainen et al., 2018) as predictors for CAM use. Need factors differed between most studies, because they investigated health product use for different indications and among different user groups (Babitsch et al., 2012) like cancer patients (Evans et al., 2007; Gratus et al., 2009). Further, many studies investigated users and usage of CAM in general or a very specific subgroup like HM (Welz et al., 2019). In Europe, little research has been conducted on NHP. The present thesis provides deeper insights into which individual (PEN) and health behavioural (HSU) factors play a role for and indicate NHP usage, in particular among users of NHP for RD and CC.

2.2 The Means-End-Chain Model

The means-end chain (MEC) model was derived from marketing research in the 1980's and was developed to understand consumers' behaviour based on personal values and their relationship to product features. The model conceptualizes cognitive processes in consumers' decision-making by taking choice-relevant elements with different levels of abstractions (Kilwinger & van Dam, 2021) and their connections into account. Several psychological theories build the base of the MEC theory. Examples are the theory of human values by Rokeach (Rokeach, 1973), which was also the basis for Schwartz' theory of values (Schwartz, 1992), and the Expectancy-Value Theory by Rosenberg (1956). The latter is based on the assumption that values are linked to consequences, implies that each action carries consequences and that individuals learn to link specific consequences to particular product attributes. Figure 4 gives an overview on the theoretical framework of the MEC model.

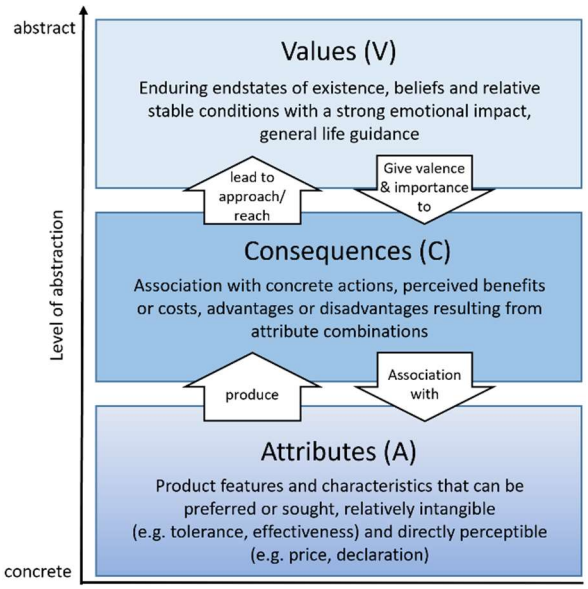

Figure 4 MEC model theory. Own illustration

The MEC model sets a hierarchical framework for elements involved in the consumer's choice process and build one theoretical base for the thesis at hand. Concrete product attributes (A), which can be directly perceptible (e.g. declaration of ingredients) or relatively intangible (e.g. tolerance), are the conscious base for consumers differentiation between products. Such attributes, product features and characteristics, are associated with specific practical, social or psychological consequences (C). Consequences are perceived benefits or costs, such as feeling physically or psychologically fit or comfortable. They bring an individual closer or further apart from personal values (V). Values are relatively stable beliefs and conditions with strong emotional impacts, the aspired end states of existence, which strive for guiding life decisions and actions (Reynolds, 1985; Reynolds & Gutman, 1988). They rule the evaluation and importance of consequences and can be a reason why a consequence is evaluated as desirable and beneficial or as undesirable. Along the chain, consequences are associated with concrete product attributes. They determine the focus of perceived advantages or

disadvantages and regulate product attribute preferences (Reynolds, 1985). As an example, an NHP with a good tolerance (A), leads to feeling physically fit (C). Feeling fit can be related to health, which might be important for an individual to perceive security (V). Looking at this chain the other way around, a strong security value might give importance to health and further to physical fitness, as they are expected to bring oneself closer to the desired security. An individual can learn, to link consequences to the result of specific attributes such as associate fitness to a good product tolerance.

MEC theory is connected with laddering, a research method that will be further discussed in the methods section. The in-depth approach contours the consumers cognitive structure and allows an optimized development for new product positioning (Reynolds & Gutman, 1988). It finds application in a variety of fields in market research, reaching from product development and evaluation to advertising and market segmentation (Kilwinger & van Dam, 2021). The following paragraph gives an additional overview on values in the way they were used for this thesis as well as provides their concrete definitions and further classifications into value-orientations.

2.3 Values

Values are beliefs and linked to affect and emotions. When the values one rates as important are violated, negative emotions occur. When individually important values are served, positive emotions set in. Values guide choice by serving as standards or criteria and are related to desired, action-motivating, goals. Based on the consequences one expects from an action or non-action regarding coming closer or distancing themselves from appreciated values, humans evaluate what is good or bad.

Contrary to norms and attitudes, which usually apply to specific situations, values apply and have relevance across situations and actions. Additionally, different from norms and attitudes, everybody has an individually and characteristically structured system of value priorities, where values are hierarchical and relative to one another ordered by importance. Actions and choices are guided by the relative importance of numerous values. However, in daily decision-making the impact of values remains mainly unconscious. They become conscious when an action or situation triggers individually important but conflicting values. In general, every behaviour or attitude involves multiple values, which are important to the individual within a relevant context. Individuals' behaviour and action or choice is the result of the trade-off between triggered and relevant, possibly competing values (Schwartz, 1992, 2012).

According to the theory of values by Schwartz (Schwartz, 1992, 2012), humans have ten motivationally profound types of values, which build the base for selection and evaluation processes and guide

actions by functioning as standards or criteria (Rokeach, 1973; Schwartz, 1992, 2012). Table 2 gives an overview of those ten basic values, including their description.

Table 2 Basic values and value orientations by Schwartz. Source: Schwartz 2012 (49). Own illustration

Value orientation	Value	Description
Self-enhancement	Power	Social status and prestige, control or dominance over people and resources.
	Achievement	Personal success through demonstrating competence according to social standards.
Openness-to-change	Hedonism*	Pleasure or sensuous gratification for oneself.
	Stimulation	Excitement, novelty and challenge in life.
	Self-direction	Independent thought and action—choosing, creating, exploring.
Self-transcendence	Universalism	Understanding, appreciation, tolerance, and protection for the welfare of all people and for nature.
	Benevolence	Preserving and enhancing the welfare of those with whom one is in frequent personal contact (the 'in-group').
Conservation	Tradition	Respect, commitment, and acceptance of the customs and ideas that one's culture or religion provides.
	Conformity	Restraint of actions, inclinations, and impulses likely to upset or harm others and violate social expectations or norms.
	Security	Safety, harmony, and stability of society, of relationships, and of self.

*hedonsim can be also part of self-enhancement

As mentioned above, values can correspond or conflict each other. They can be set on two bipolar dimensions, which describe four value orientations. One dimension holds values which attribute to openness to change characteristics, including self-direction, stimulation and hedonism (Schwartz, 2012). Openness is a characteristic, which was previously found to be associated with CAM use (Honda & Jacobson, 2005; Sirois & Purc-Stephenson, 2008).

The opposed dimension is conservation, which includes the values of tradition, security and conformity. On the other dimension scale, universalism and benevolence are part of the self-transcendence value orientation. Self-transcendence describes a focus on welfare and interests of others. Opposed is self-enhancing, which includes values such as power and achievement (Schwartz, 2012).

In self-directed and shared health decision-making, values impact preferences for particular treatment options. In shared decision-making, the values of all involved parties, of health professionals and patients, impact the individual treatment choice. Every day, health professionals endeavour to provide the best possible care for their patients. They exert their influence on the decision-making process by a preselection of treatment options based on their values and further by their communication behaviour (e.g. recommendations), which in turn is also affected by their individual values (Baldt, 2019). A study among 637 physicians found two different groups: One group of physicians had strong

achievement, power (regarding resources) and conformity (to interpersonal standards) values. Physicians in this group used risk-relative approaches, meaning their assessment standards were stricter the higher the risk. In the other group, physicians held higher hedonism, conformity (to rules) and universalism-related values. People in this group used the same criteria for the evaluation of a situation, neglecting the risk (Hermann et al., 2015). While the impact of values of health professionals is critically scrutinized (Wiesing, 2017), the influence and consideration of values of patients in health decision-making is appreciated (Baldt, 2019). In patient-centred approaches, health professionals take the individual values and preferences of their patients into account without disregarding scientific evidence (Bastemeijer et al., 2017). Research addressed patient values from different, mainly explorative perspectives. The term value is often used together with preferences, either as a determinant (Haynes et al., 2002) or a synonymous (Bastemeijer et al., 2017; Charles et al., 2011). There is a lack of consistency in the definition of value. The present work uses a clearly framed definition of values as suggested by Schwartz (2012) to determine their influence on health decisions with the example of using natural health products. In contrast to prescribed treatments, they are available OTC and can be taken with and without consultation of health professionals. For either approach, the market offers a variety of alternatives, which make decision-making more complex.

3 Research objectives

As mapped out in the previous chapters, little knowledge exists on the NHP consumers' characteristics and behaviours, especially considering their impact on NHP decision-making. Thus, this thesis has the following main objectives:

Investigating…

(1) …which individual and health behavioural factors explain NHP usage in the German population.
(2) …which value orientations impact NHP usage.
(3) a) …which values guide the cognitive process on decision-making related to NHP.
b) …consumers' association chains from choice relevant NHP attributes up to the abstract level of values.

Research objectives 1 and 2 were particularly focused on RD-NHP users (Paper 1) and NHPCC users (Paper2). All in all, this thesis is composed of three major parts, on which Figure 5 gives an overview.

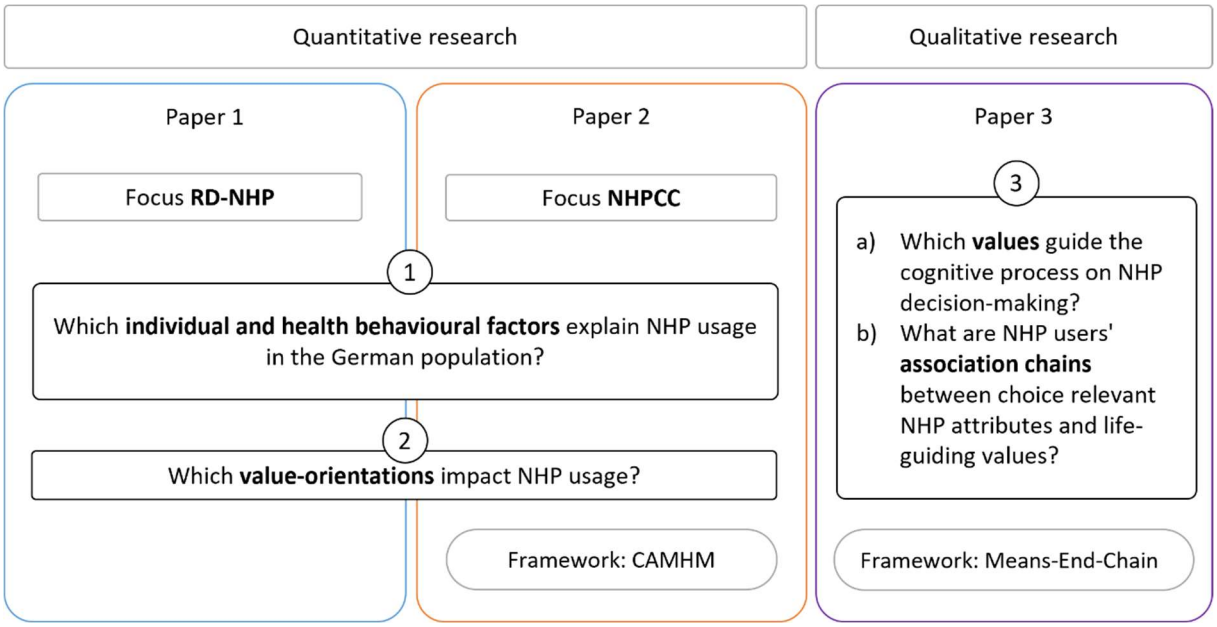

Figure 5 Structure of the thesis with research questions

Paper 1 and Paper 2 were based on a quantitative research approach, using data from a nationwide online survey in Germany. They addressed two to date specifically in Western Europe under-researched target groups of NHP users. Both papers determined, which individual factors, with a special attention to value orientations and health behavioural factors, explain NHP usage in the German population. The focus was on NHP for mainly non-life-threatening health issues that are treatable by self-medication. Paper 1 investigated RD-NHP users and usage. The recent Covid-19 pandemic highlighted the issue of RD-treatment and prevention, for which NHP are a widespread and

popular option (Karataş et al., 2021; C. Liu et al., 2021; Nguyen et al., 2021; Yáñez et al., 2021). However, little knowledge existed about RD-NHP users and their NHP usage behaviour in Germany – a research gap which this study is aiming to fill. Paper 2 set another, to date under-researched indication and respective target group into focus: Usage and users of NHP for concentration and cognition. Even though CC issues and related diseases like dementia are increasing in many parts of the world (Chopade et al., 2023; Ferrucci et al., 2021; Gauthier et al., 2021), the users and the usage of NHPCC have not been intensively researched. In this study, the CAMHM was used as a conceptual framework to identify factors particularly related to NHPCC usage.

In paper 3, the research transformed from the broader macro-approach to a more psychological micro-level approach. Applying the MEC approach, it focuses on the NHP decision-making process on a cognitive level, in particular choice guiding values and their linkages with product attributes. These insights into the decision-making process on NHP complement the results of the quantitative studies. Altogether, the studies of this thesis provide new knowledge that healthcare providers can implement in and use for optimization of their communication activities. For example, practitioners can use it to consult their patients in case of shared decision-making to find the best health service and product options for NHP users under consideration of the consumers values. For self-medicated NHP, manufacturers and retailers can use the results for more consumer-centric product development, as well as for positioning and improving marketing communication strategies by considering choice-relevant links between product attributes and consumer values (Costa et al., 2004).

4 Methods

The next sections go further into detail concerning the methods used for the studies of this thesis, beginning with sections about the quantitative approach, followed by the qualitative approach.

Figure 6 gives an overview of the methodical approaches and instruments applied in the three papers being subject to the present thesis. Paper 1 and Paper 2 were based on quantitative research, using data that were collected via an online survey. Descriptive and inferential statistics were used to determine which individual and health behavioural factors explain NHP usage in different user groups. Paper 1 focused particularly on users of NHP for RD indications. Individuals who indicated NHP usage within the previous 12 months for flu/cold, cough, or Covid-19 indications were categorized as RD-NHP users. All other NHP users belonged to the non-RD user (nRD-NHP user) category. Participants with no NHP usage experience were grouped to non-NHP users. Paper 2 focused particularly on users of NHP for CC indications. Individuals who had used NHP within the previous 12 months were defined as current NHP users (n=1229) and were further divided into two subgroups: NHPCC users, who indicated NHP usage directly for CC indications or for the related indications of tinnitus (Bankstahl & Görtelmeyer, 2013; Brueggemann et al., 2021; Degeest et al., 2022; Jafari et al., 2019), dementia (Avan & Hachinski, 2023; Trzepacz et al., 2014), migraines and headaches (Gerstein et al., 2023; Meyer et al., 2000). Current NHP users who did not use NHP for these indications were defined as nCC-NHP users. Participants who indicated NHP usage but not within the previous 12 months were defined as past NHP users. Paper 3 is based on qualitative research. The target group were NHP users in the general German population, who were interviewed under application of the laddering technique and whose resulting data were analysed according to the means-end-chain model.

<table>
<tr><th></th><th>Paper 1</th><th>Paper 2</th><th>Paper 3</th></tr>
<tr><td>Approach</td><td colspan="2">Quantitative research</td><td>Qualitative research</td></tr>
<tr><td>Data collection method</td><td colspan="2">Representative nationwide online survey in Germany</td><td>In-depth laddering interviews</td></tr>
<tr><td rowspan="2">Target group</td><td colspan="3">General German population, 18 years +</td></tr>
<tr><td>RD-NHP user, nRD-NHP user, non-NHP
(12 month prevalence)</td><td>NHPCC user, nCC-NHP user, past NHP user
(12 month prevalence)</td><td>NHP user, German speaking</td></tr>
<tr><td>Data analyses</td><td>Descriptive and inferential statistics, multinomial logistic regression model</td><td>Descriptive and inferential statistics, binomial logistic regression models</td><td>Qualitative content analysis, creation and analyzes of a hierarchical value map over the dominant association chains</td></tr>
<tr><td>Software</td><td colspan="2">Questionnaire design: Lighthouse studio;
Analyses: SPSS for Windows release 29</td><td>MAXQDA 2020;
Microsoft Excel</td></tr>
</table>

Figure 6 Methodical overview of the papers of the thesis

4.1 Quantitative approach

For the first two papers of the thesis, a quantitative methodical approach was conducted. Quantitative research includes several methods for a systematic investigation of social and behavioural phenomena, including numerical and statistical data analysis (Watson, 2015).

To gain insights about characteristics and health behaviours of NHP users and related influencing factors, particularly for specific indications on the examples of CC and RD, a cross-sectional online study was conducted in Germany in April 2022. The study received approval from the Ethics Commission of the Faculty of Medicine, Technical University of Munich, on 2nd April 2022.

4.1.1 Participants

A marketing research institute was responsible for the recruitment of the participants. Requirements to participate in the online survey were a minimum age of 18 years, a residence in Germany, and sufficient German language skills. Quota sampling was used to obtain a representative sample of the adult (18 years +) German population regarding the statistical distribution of gender, age, federal state, and size of residence town. In total, 2207 individuals completed the online questionnaire. Data screening and cleaning were performed according to Schendera (Schendera, 2011) to ensure the dataset is reliable and valid. Straight-liners, who have always chosen the same response options for the APSA and/or SSVS and speeders, who finished the questionnaire in half of the median time of their respective sample group (NHP user: participants who answered the whole questionnaire; non-NHP user: participants who skipped to part 2 of the questionnaire after the first question in part 1) were excluded. The remaining and final dataset for further analyses consisted of 1707 participants. It included 53.1% female and 46.9% male participants, 49.6% had less than 12 years of education (50.4% >= 12 years of education), 19.4% had children living in the same household (80.6% no children in the same household), 62.9% were employed (37.1% unemployed), 14.6% were aged 18 – 29 years, 48.6% were aged 30 – 59 years and 36.8% were aged 60 years or older. The sample comprised 1464 NHP and 243 non-NHP users. Out of the NHP users, 794 participants indicated RD-NHP usage in the past 12 months, and 236 participants used NHPCC.

4.1.2 Questionnaire design

The questionnaire was developed based on the results of the qualitative study as well as established scales and items from previous studies. The questionnaire contained two main parts: The first part was about NHP usage patterns and experience. The second part contained questions about general health and health behaviour, including an Attention and Performance Self-Assessment (APSA), the Short Schwartz Value Survey (SSVS), and finally, sociodemographic questions. The first question in part 1 enabled to distinguish NHP users from non-NHP users. Non-NHP users skipped the follow-up questions

of part 1 and continued directly with part 2. Participants with NHP usage experience completed the whole questionnaire.

In the first part, NHP users continued answering questions about the indication fields of their NHP usage and whether they have used NHP within the previous 12 months. User groups for paper 1 and paper 2 were defined according to participants' responses to these questions. Figure 7 visualizes the grouping of the sample for both papers.

All NHP users answered further questions about their NHP usage aims (health support, illness prevention, and disease treatment), NHP information and supply sources, NHP self-medication, and changes in NHP consumption patterns since the beginning of the Covid-19 pandemic.

In the second part of the questionnaire, all participants responded to questions evaluating their general health condition, present chronic diseases, information sources for non-life-threatening health complaints, preventive health activities such as vaccinations, and if they had a positive Covid-19 test result within the previous 6 months. It further contained the APSA, where participants were asked to rate statements regarding their daily attention and concentration performance on a five-point Likert scale (never to always) and how often these had occurred to them within the past 4 weeks. This was followed by the SSVS including a short description of the 10 basic values, which participants rated on a seven-point Likert scale according to their importance in life (from against my values to of supreme importance). The last section contained sociodemographic questions about education, occupation, household size, and health insurance.

Appendix A provides an excerpt of the questionnaire, including all questions relevant to this thesis. More detailed descriptions can also be found in the related publications 1 and 2. As shown in Figure 7, paper 1’s sample and paper 2’s sample are based on one online survey. Thus, there is some overlap: the data of NHP users are used in both paper 1 and paper 2.

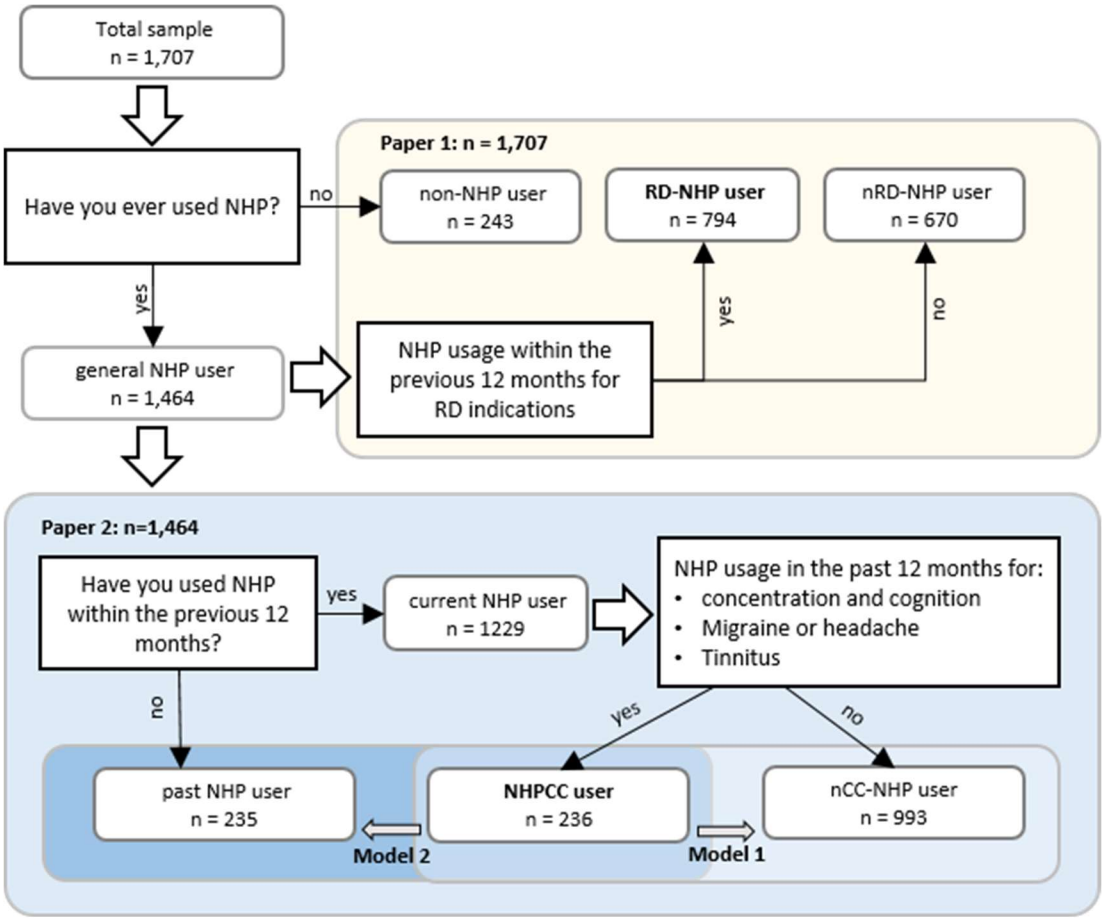

Figure 7 Definition of user groups for paper 1 and paper 2 based on the online questionnaire

4.1.3 Data analysis

Data were analysed using descriptive and inferential statistics as well as a multinomial logistic regression model in publication 1 and binomial logistic regression models in publication 2.

Descriptive and inferential statistics applied in both publications were frequencies, percentages, mean values and Chi-square tests to determine which independent variables differed significantly between the three groups in each paper. All significant tests were performed on a $p<0.05$ level. Cramer's V-vales were calculated for effect sizes. Additionally, in paper 2, z-tests were performed to determine the subset of user groups whose proportions differed significantly from each other.

Value orientations were analysed according to Boer (2013) and the APSA was analysed following the recommendations by Bankstahl and Görtelmeyer (2013) (Bankstahl & Görtelmeyer, 2013). Therefore, similarly to the general health condition, mean values and standard deviations (SD) were calculated. Further, Levene Statistics were used to check if homogeneity of variances was violated. As suggested by Field, when the assumption of homogeneity of variances ($p <0.05$) was validated (as for value-orientations), an ANOVA was performed for group comparisons, ω^2 for effect size calculations, and Hochberg GT2 for post-hoc comparisons. When the assumption of homogeneity of variances was

violated, as it was the case for the APSA, the Games-Howell test was used for post-hoc comparisons (Field, 2018).

In paper 1, a multinomial regression was used, to compare RD-NHP users with nRD-NHP users and non-NHP users. Independent variables included sociodemographic data, health related behavioural characteristics and value orientations. In paper 2, two binomial logistic regressions were performed, to determine which factors predict NHPCC usage as opposed to nCC-NHP usage (model 1) and as opposed to past NHP usage (model 2). For the purpose of this thesis, independent variables, which were the same in both models, were categorized in predisposing, enabling, need and health service use factors. To analyse how much each factor block contributed to the explained variance in each model and to compare their impact in both models, Nagelkerke R^2 values were calculated for each factor block.

4.2 Qualitative approach

Qualitative research aims to deepen the understanding of human behaviour by providing insights into human thinking, feeling, and decision-making, answering the question of why something happens the way it does. It does not necessarily aim to study a statistically representative sample. Common methods include interviews, focus groups or participant observations (Al-Busaidi, 2008; Busetto et al., 2020).

NHP are mainly sold OTC. Decision-making on such products can rely on product design, which addresses consumers' preferences for concrete attributes and their underlying values (Drumond, 2020). To examine which concrete product attributes are important for NHP decision-making and how they are linked to decision-guiding values, a qualitative study was conducted using the Means-End-Chain (MEC) approach with laddering interviews.

The qualitative study took place from October to November 2020. The Ethics Commission of the Faculty of Medicine, Technical University of Munich, gave their approval on 8th October 2020.

4.2.1 Study design and data collection

Participants were recruited via announcements in local newspapers and in the surroundings of the doctoral candidate's scientific institute. Requirements for participation were personal experience with NHP consumption, sufficient German skills and a minimum age of 18 years. 26 individuals participated in this study.

The 26 one-on-one interviews were semi-structured, including an in-depth interview part during the laddering section. Participants filled in a standardized questionnaire about their sociodemographic data which required previously given written informed consent.

The semi-structured interview-guideline was developed according to the research question and the suggestions provided by Reynolds and Gutman (Reynolds & Gutman, 1988). All interviews started with the participants sharing their experience with NHP. Afterwards, a thought-experiment took place, where participants could imaginary build their ideal NHP. The descriptions the participant gave were scribbled on a whiteboard by the interviewer. The interviewer summarized the attributes the participant mentioned on cards, which the participant rated regarding their personal importance in NHP decision-making. The highest ranked product attributes were used to start the laddering. Answering to the content-wise repeated question "Why is this important for you?" participants climbed their ladders starting with an attribute via associated consequences up to the abstract levels of decision-guiding values. The interview-guideline for the laddering-interviews is provided in Appendix B. The interview procedure took between 50 and 90 minutes per participant and was audio-taped.

4.2.2 Data analysis

The audiotapes of the interviews were verbatim transcribed. Each transcript was two times cross-checked. Qualitative content analysis was realized using the software MAXQDA 2020 (VERBI Software, 2020) for structuring, systemizing, and coding the transcripts. Coding was applied according to the instructions of Reynolds and Gutman (Reynolds & Gutman, 1988). Inductive coding, which generates themes openly from the dataset, was used to map the initial individual ladders. Deductive coding, which uses pre-selected themes and codes based on previous research, literature and theories (Gale et al., 2013), was used to categorize the codes into the attribute, consequence or value category. Values were coded based on the definitions by Schwartz (Schwartz, 2012). With summary codes which were applicable on several interview transcripts, the doctoral candidate developed an initial code system. Two student research assistants applied the code system individually on each transcript and worked out the ladders for each participant. Ladders contained between four and fourteen elements (mean = 8). Each complete ladder started on the attribute level, which was linked to consequences, and finally connected to the abstract level of values. In regular meetings, findings were discussed with the student assistants. If necessary, the code system was adapted. This procedure ensured intercoder reliability and aligned ladders. The final code system can be found in Appendix C.

The MEC approach is a special form of qualitative research, as qualitative collected data are transformed into quantitative results (Kilwinger & van Dam, 2021). After all ladders for each participant were recorded using the final code system, qualitative data were transformed into a quantitative data set. To do so, all links between the elements in one ladder were entered into an Excel sheet. This included direct links as well as indirect links when elements in one ladder were indirectly connected by having one or more elements in between. Each link between two elements was counted once per

participant, as the focus of the data analysis laid on commonly shared links across the sample rather than on individual contextual links (Kilwinger & van Dam, 2021).

The results were used to build an implication matrix, which gives an overview about the counts of direct and indirect links between two elements across all participants. The implication matrix built the basis to reconstruct association chains, valid for the whole sample. These new chains were pictured in a hierarchical value map (HVM). To ensure a tractable and clear visualization of the elements and their links within the HVM, a cutoff-level was set. Thus, elements and links which were mentioned by less participants than the set cut-off level allowed, did not appear in the HVM. As there are no statistical or theoretical instruction for the definition of the cutoff level (Grunert & Grunert, 1995), cutoff levels between one and five were tried out. Finally, a cutoff level of 3 was chosen, because it provided the most adequate balance between HVM clarity and bearable information loss. The final HVM presented the dominant attribute-consequence-value association chains in NHP decision-making across the sample, distinguishing between weaker and stronger links according to how many participants mentioned the given link between two elements. A more detailed description of the procedure of this qualitative study can be found in publication 3.

4.2.3 Trustworthiness

One issue concerning qualitative research methods is trustworthiness. According to Lincoln and Guba (1985), trustworthiness can be established by credibility, confirmability, dependability, and transferability (Lincoln & Guba, 1985). To address credibility, data collection and analysis were done following the established MEC-approach. Further, data analyses were realized by several researchers, which is a common way to enhance credibility (Stahl & King, 2020). To reduce subjective bias by the researchers and improve credibility, briefings and meetings with reflections and discussions took place in a regular manner. Dependability was ensured by using consistent methodical approaches throughout the whole study. To ensure transferability, the context, timeframe and methods used for this study were carefully reported.

5. Results

This chapter provides an overview of the results of this research, which are presented in more detail in the papers related to this thesis. The overview includes a summary of research objectives, methodologies used, and each paper's main findings. Appendix D provides the full version of the papers.

5.1 Paper 1

The article *"Usage of Natural Health Products (NHP) for Respiratory Diseases: User Characteristics and NHP Consumption Behavior during the Covid-19 Pandemic in Germany"* was published on 21th October 2023 in the BMC Complementary and Alternative Therapies Journal.

The doctoral candidate took care of the study design, data collection, analysis and interpretation, as well as article writing. She is the first author of this paper. The co-authors were Dr. Agnes Emberger-Klein and Prof. Dr. Klaus Menrad, who supported the whole study and article writing.

RD are very prevalent diseases in primary medical care (Incze et al., 2018; Jin et al., 2021) and affect most people of all ages several times a year (Zavalishina et al., 2021). Even though RD mainly have mild to moderate progressions, the SARS-Covid-19 pandemic demonstrated their potential threat to healthcare systems worldwide (Lavine et al., 2021). NHP, including RD-NHP, are often available OTC and taken as self-medication (Welz et al., 2019), which gives them the potential to be effective CAM to reduce the burden of healthcare systems. In this respect, it is essential to understand NHP consumption behaviour and self-practice to provide safe healthcare advice (Paudyal et al., 2022). Therefore, knowledge about personal and health-behaviour-related factors that explain RD-NHP usage is needed, including, for example, information sources that are often consulted by users.

To address this research gap, a cross-sectional online-survey with 1707 participants, representative for the German population, was conducted in April 2022 in Germany. Data were analysed with descriptive and inferential statistics and a multinomial logistic regression model. Participants were categorized into three groups: 1) RD-NHP users, who have used NHP for RD indications in the past 12 months; 2) nRD-NHP user, who used NHP but not for RD indications in the past 12 months; 3) non-NHP user, who have never used NHP.

The results showed a high prevalence of RD-NHP usage in the past 12 months with 46.5% of the whole sample and 54.2% of all NHP users. RD-NHP users were more likely female, higher educated, employed, and had stronger openness-to-change value orientations than non-NHP users. Consulting pharmacists, alternative practitioners, or family and friends for non-fatal health issues was more likely for RD-NHP users than for non-NHP users. In contrast, the likelihood of consulting a general practitioner was significantly higher among non-NHP users than among RD-NHP users.

Focusing on NHP users, the likelihood of using NHP for RD indications within the previous 12 months was higher when individuals had children living in their household, were employed, lived in an Eastern German federal state, suffered from a Covid-19 infection within the past 6 months, and more frequently consulted general practitioners or pharmacists for non-fatal health issues. Value orientations did not significantly differ between RD-NHP and nRD-NHP users.

Most RD-NHP users take NHP for health support or maintenance and to treat diseases or symptoms. The majority reported no change in the amount of used NHP since the beginning of the Covid-19 pandemic. Nevertheless, the share of individuals who took more NHP since the pandemic was more than three times higher than the share of individuals who took fewer NHP. The share of RD-NHP users who took new NHP, which they had not used before the pandemic, was even higher than of those who used more NHP than in pre-pandemic times. While the most considerable majority indicated self-medication with NHP, more than two-thirds did not inform their practitioner about the self-practice. Most RD-NHP users got information about NHP on-product, for example, by reading the declaration. Pharmacists were the second strongest source for information about NHP, followed by family and friends. RD-NHP users purchased NHP mainly in drugstores, followed by pharmacies.

This study gave insights into the NHP usage and health related behaviour especially of RD-NHP users. The findings are important, as they can help to develop and optimize future pandemic-control and communication strategies under the consideration of the potential and popularity of NHP, by taking NHP health and information behaviour into account.

5.2 Paper 2

The article *"Factors influencing the use of Natural Health Products, in particular for concentration and cognition in Germany"* was published in the Journal BMC Complementary and Alternative Therapies on 27th February 2024.

The doctoral candidate is the first author of this paper. She took care of the study design, data collection, analysis and interpretation, as well as article writing. The co-authors were Dr. Agnes Emberger-Klein and Prof. Dr. Klaus Menrad, who supported the whole study and article writing.

NHP are an important part of CAM. Their use is implemented in many cultures and healthcare systems (Eardley et al., 2012; Ganesan, 2008; Thakkar et al., 2020). They are a popular treatment option for diseases and symptoms as well as for prevention and health support (Welz et al., 2018, 2019). To get deeper insights into healthcare decision-making, previous studies have called for empirical testing of CAM healthcare models (Fouladbakhsh & Stommel, 2007; National Center for Complementary and Integrative Health, 2004). Research based on survey data is needed, focusing on individuals' characteristics and CAM health behaviour (Iacobucci, 2019; Zhu et al., 2022). Thus, this study aimed to

determine NHP prevalence in Germany and to identify key psychological, sociocultural, and economic factors that affect consumer decisions regarding NHP usage behaviour within the framework of the CAMHM. One indication of NHP which affects people across all ages and social classes is concentration and cognition (CC) (Brühl & Sahakian, 2016; d'Angelo et al., 2017; Gauthier et al., 2021). Therefore, this study analysed particularly PEN and HSU factors that explain NHP usage with a special focus on the usage of NHPCC.

Data for this study were collected via a nationwide online-survey (n=1707). This study included all participants who had NHP usage experience (n=1464). According to their NHP usage behaviour, they were subdivided into three groups: Participants, who have 1) used NHP for CC indications within the previous 12 months (NHPCC user); 2) used NHP in the last 12 months but not for CC indications (nCC-NHP user); 3) used NHP before but not in in the previous 12 months (past NHP user). Descriptive and inferential statistics, and two binary logistic regression models to compare NHPCC users to nCC-NHP users (model 1) and to past NHP users (model 2) were used for data analysis.

Results showed a high 12-month prevalence of 83.9% for NHP usage, including 16.1% being NHPCC users. Significant differences between the groups were found for gender, age, education and children in the same household. Additionally, past NHP users had significantly lower openness-to-change and self-transcendence value orientations than the other two groups. Occupation status and all NHP information sources apart from family and friends were enabling factors, which had significantly different shares among the user groups. This also applied to the need factors of suffering from chronical diseases and the results of the APSA. In this context, NHPCC users indicated difficulties in daily attention and memory performance more often than the other groups, past NHP users indicated having them the least. The HSU factors of NHP usage aims and NHP self-medication also differed significantly between the groups. Compared to past NHP users, a higher share of NHPCC and nCC-NHP users were female (predisposing factor), indicated NHP self-medication (HSU factor), and used NHP information provided directly on product or by health professionals (enabling factor). Their openness-to-change value orientations were stronger than the one of past users. The likelihood of being an NHPCC user increased, if an individual had more difficulties in daily attention and memory performance (need factor), when NHP information seeking was done by taking health professionals and literature into account (enabling factors), and when NHP were used for health support and illness prevention (HSU factor). Furthermore, being female, practicing NHP self-medication and holding higher values of self-transcendence were significant predictors for NHPCC usage compared to past NHP usage.

Framed in the CAMHM, this study gives insights on predisposing, enabling, need, and health service use factors, which are characteristic for NHP usage. Further, it examined which factors indicate NHPCC

usage as distinguished from nCC-NHP and past NHP usage. The total explained variance was higher in regression model 2 (past NHP user vs. NHPCC user) than in model one (nCC-NHP user vs. NHPCC user). In both models, enabling factors explained most of the variance, followed by HSU factors. Need- factors contributed least to the explained variances. However, both models showed high correct classification rates. The results of this study highlight the important role of health professionals and on-product information for NHP information seeking as well as the potential of literature and journals for being suitable channels for information about NHPCC.

5.3 Paper 3

The article "*From Consumer Values to Attributes of Natural Health Products for Concentration and Cognition: Insights from a Means-End-Chain Study"* has been published in the Journal of Pharmaceutical and Healthcare Marketing on 6th November 2023.

The first author of this article is the doctoral candidate, who took care of the study design, data collection, analysis and interpretation, and article writing. Two student assistant scientists supported data analysis. The co-authors of this article, Dr. Agnes Emberger-Klein and Prof. Dr. Klaus Menrad, supported the whole study and article writing.

CC are important for individuals across all ages and social classes. NHP are a popular CAM option to enhance CC or deal with CC issues. Because NHP are mainly non-descriptive and self-medicated, their usage requires active decision-making of consumers. This study aimed to derive insights into cognitive association chains between concrete product attributes, associated consequences, and overall values, which guide consumers' decision-making.

To reach this objective, a qualitative MEC approach was chosen. Therefore, 26 one-in-one in-depth interviews were conducted, applying the new design-thinking method of scribble to figure out the most important product attributes of NHPCC. From there, the laddering technique was used to disclose association chains via linked consequences up to the abstract values. Interviews were audiotaped, transcribed, and analysed according to the MEC procedure as described by Reynolds and Gutman (Reynolds & Gutman, 1988)

Interviewees were predominantly female, middle-aged, higher educated, publicly health-insured, and lived in single or three or more person households with a monthly net income of 2000€ or more. All participants had experience with either OTC herbal medicine, natural nutrition supplements, or both.

The resulting HVM of this study presents insights into the cognitive structure of NHP decision-making via association chains across elements with different levels of abstractedness, reaching from concrete

product attributes via consequences up to the abstract level of values. Many elements in the HVM have several in- or outgoing links, highlighting the complexity of NHP decision-making.

The HVM shows eight choice-relevant product attributes. Four of them, namely effectiveness, tolerance, declaration, and sustainability, are directly associated with consequences. One almost stand-alone association chain started from the concrete attributes of regionality and sustainability. Via the instrumental value of environmental protection, the chain approached the terminal value of benevolence and additionally exhibiting a strong link to universalism. Both values are self-transcendent orientated.

Effectiveness was the most mentioned attribute, often high-scored in the attribute rankings, and associated with other attributes such as ingredients, declaration, and tolerance. Going from there, the most mentioned consequence was a conscious consumption decision, strongly associated with knowledge gain and trust. Further consequences interlaced with each other and across the levels directly or indirectly, which mirrors the complexity of cognitive structures and decision-making.

More than ¾ of participants mentioned the instrumental value of health as being important to their decision-making on NHP. Health was linked to the terminal values of security and self-direction. Self-direction and stimulation, the fifth terminal value occurring in the HVM, belong to the openness-to-change value orientation. Thus, apart from security, all terminal values belong to anxiety-free-related values (Schwartz, 2012) and have close underlying motivations. This study's findings encourage considering values in further healthcare utilization models to deepen the understanding of their role in decision-making.

Further, the results of this study provided valuable insights to NHP decision-making by determining consumer association chains reaching from concrete product attributes up to abstract and mainly unconscious decision-guiding values. NHP manufacturers and health professionals can consider those association chains to develop new and optimized NHP products, information strategies, and therapies with shared decision-making in a consumer-centred way.

6. Discussion

This chapter provides an overall discussion of the methodical approaches and presents their limitations. Further, it includes the discussion of the results of this thesis and points out prospects for future studies.

6.1 Methodical discussion

To answer the research questions of this thesis, a combination of quantitative and qualitative methods was chosen. Both approaches together allowed different perspectives on NHP users, which gives a more comprehensive picture of NHP users' characteristics, behaviour, and decision-making. Using different methods consolidated can compensate their inherent limitations and exploit pertinent benefits (Brewer & Hunter, 1989).

For paper 1 and 2, a quantitative online study, with implemented validated tests such as the SSVS and the APSA, was carried out. Online surveys have the advantage, that they are relatively time and cost effective while reaching a large number of participants (Nayak & Narayan, 2019). This approach made it possible to receive a representative sample of the German population regarding gender, age, federal state and size of the place of residence, and to efficiently analyse the collected data to determine which factors explain NHP usage. Nevertheless, online studies have some limitations. People without internet access could not participate in this study, which represents 5% of the German population in 2022 (Statistisches Bundesamt, 2023). Additionally, discrepancies in prevalence and trends between this study and previous research could inter alia arise from different sample presuppositions. For example, the study by Schäfer et al. 2021 analysed students, whereas the studies for this thesis examined a representative sample of the German population. This argument can be supported by the findings of Dreisiebner et al. (2021), who suggest that sociodemographic characteristics influence the use of different health information sources (Dreisiebner et al., 2021).

Further, the results can be biased in different ways. As there was no direct interaction between the researcher and the individual participant, the researcher could not interfere and answer questions of the participant immediately, when unclear questions or ambiguities arose during the filling out process (Nayak & Narayan, 2019). Even if the definition of terms and the posing of the questions was as neutral and clear as feasible, bias through desirability and misunderstandings cannot be entirely eliminated. Due to all answers being self-reported, inaccurate information could have occurred for retrospective questions, for example when indicating if NHP were used in the past 12 months. Nevertheless, the recall to the past 12 months prevalence was chosen, because it enabled comparisons to prevalence rates from a pre-pandemic study in Germany (Welz et al., 2019). For other questions, anchor points and broad answering categories were used to facilitate recall accuracy (Hipp et al., 2020). For instance,

to evaluate the change in the amount of used NHP, questions assessing the change since the beginning of the pandemic offered broad answering categories (more/same/fewer) rather than asking for dates and specific numbers. The change in societal norms (like promoted hygiene rituals) might have led to a shifted answering behaviour, which could reduce the comparability to pre-pandemic studies. But even if retrospective answers incline to be unreliable at the individual level, they tend to be consistent when aggregated (Hipp et al., 2020; Jaspers et al., 2009). Participants actively decided to complete the questionnaire. Even though an interest in NHP was not a condition for participation, the sample could be slightly biased towards people with a higher interest in NHP. Therefore, general NHP usage prevalence rates could be overestimated. Additionally, previous studies use different operational definitions of CAM, NHP and HM, to some extent caused by different cultural contexts. This might limit exact comparability across studies, for example regarding prevalence rates (Lee et al., 2022). Results are likely not entirely transferable to other nations, in particular regarding to value-orientations, as values differ between cultures (Schwartz, 2007; Struch et al., 2002). However, the results of this work underline the relevance of values on NHP decisions. To deepen the understanding of values and value-orientations as defined by Schwartz (2007) in healthcare decision-making, prospective research should consider their inclusion in the chosen healthcare utilization models. Both quantitative studies of this work focused on NHP usage for one specific indication (RD or CC). Only NHP usage was assessed in the questionnaire, leaving out alternatives such as synthetic medicine or mind and body practices for the indication. Future research should consider and use the findings of this study and analyse whether the predictors for specific NHP usage are also applicable to other kinds of CAM.

The first study focused on RD-NHP users and compared them to nRD-NHP users and non-NHP users on a 12-month prevalence. Due to the inclusion of non-NHP users, especially health service use factors were the main focus of general health behaviour rather than NHP related behaviour, because non-NHP users did not answer any questions about behaviour related to NHP. Thus, variables in this study were initially not categorized into the factor blocks as suggested by the CAMHM. A separate table was created, showing NHP related health service use and behaviour pattern of RD-NHP users during the Covid-19 pandemic in Germany. However, apart from the general health behaviour-related factors, the remaining variables are transferable to the PEN factors as suggested by the CAMHM and the ABM. In retrospective, an analysis of NHP health-related behaviour could have been additionally performed for nRD-NHP users. If instead of a multinomial logistic regression, two binomial logistic regressions had been performed, such NHP related HSU factors could have been included into the binomial logistic regression of nRD-NHP vs RD-NHP users. This model would have had more overlapping variables with the study in paper 2 about NHPCC users. However, a multinomial logistic regression was performed for the RD-NHP paper, because it had the advantage of determining the impact of the same set of independent variables on the dependent variable with three categories (RD-NHP, nRD-NHP and non-

NHP user). The results of the multinomial logistic regression and additional descriptive analysis of NHP HSU data for RD-NHP users provided interesting information relevant to answer the research question 1 on which factors explain NHP usage and which value orientations impact NHP usage with a special focus on RD-NHP. The study for paper 2 addressed the same research question but focused on users of NHP for CC indications. To figure out which factors explain NHPCC usage compared to nCC-NHP and past NHP usage, two binomial logistic regressions were conducted. Variables in this study were categorized according to the CAMHM into PEN and HSU factors. Both binomial logistic regressions used the same set of variables, which made it possible to test the CAMHM on general and specific NHP usage. There were no previous studies found, which tested the CAMHM in this way, accrediting this paper a further research contribution. Because predictors of NHP usage differ between indication, for example between chronic and acute diseases (Chowdhuri & Kundu, 2020), future research could apply and test the CAMHM for further NHP indications.

The online survey did not provide deeper insights into the cognitive process of NHP decision-making. To gain more insight into this field, a qualitative data collection method was therefore performed. Thereby, in-depth interviews, including the laddering technique according to the MEC theory, were conducted. This method empowered participants to think deeper about their decision-making on NHP. They were enabled to articulate their cognitive decision process all the way from concrete product attributes up to the abstract level of values, which are seldom consciously sensed during the decision-making process. Qualitative research allows to get detailed information about related topics, underlying values and an idea of their relevance for the individual (Mwita, 2022). The PhD candidate was directly interacting with each participant individually. On the one hand, this enabled direct questions and clarifications of understanding from both parties. On the other hand, despite her training and all precautions taken, desirability (answering according to assumed social expectations) and hindsight bias (Tavory, 2020) cannot be completely eliminated. Additionally, qualitative data analysis is quite interpretive. Researchers may be biased by subjective interpretations and reporting when analysing the data (Mwita, 2022). To ensure credibility and trustworthiness, the analysis procedure was done with several researchers, as described in detail in chapter 4.2 Qualitative approach”

The interviews of the qualitative study took place shortly before and at the beginning of the second Covid-19 wave, including the light lockdown from mid of November 2020 in Germany. During the data collection period, legal regulations about personal meetings changed several times (Bundesministerium für Gesundheit, 2023). For example, the obligation to wear masks during the whole interview applied when Covid-19 incidence rates exceeded defined critical values. Some participants mentioned discomfort regarding the masks. The setting can impact interviewees’

behaviours (Dempsey et al., 2016; Morrison, 2013). However, all participants had chosen to participate and complete the interviews voluntary. Within the framework of existing legislation, the interviewer did her best to realize a good interview atmosphere. It was possible, to complete the study successfully while following the varying Covid-19-related legal regulations which sometimes changed between the individual interview days.

Qualitative research sets the focus on small samples that can provide purposeful detailed information rather than on large representative samples (Sale et al., 2002). The sample size of the qualitative was relatively small, but met the recommended minimum of 20 participants by Kilwinger and van Dam (2021). However, the results may not be generalizable. Sociodemographic characteristics are mirroring those of NHP users, rather than NHPCC users (McDermott et al., 2021; Merwid-Ląd et al., 2023; Welz et al., 2019). For example, the unequal gender distribution of the sample could have influenced, but does not necessarily bias findings on values (Prince-Gibson & Schwartz, 1998; Struch et al., 2002) and preferred attributes (Aulia & Putro, 2022). The sample structure is likely the result of the participation-precondition of having used NHP in general. Only few participants mentioned experience with NHPCC. Thus, the present study gives insights to general NHP user decision-making on NHP for non-fatal health issues such as CC. A precondition of NHPCC usage experience could have provided a deeper understanding of NHPCC user decision-making on NHPCC. As the study was conducted in a small area of Bavaria, results are likely not transferable to other cultures and might not be representative for the whole German population.

Analogies to comparable studies conducted in other countries and economies can facilitate insights into macro- and micro-level differences between healthcare systems and their impact on healthcare decision-making from an individual consumer, industry and policy perspective (Zhu et al., 2022). To evaluate product preferences for NHP like NHPCC in a broader range, further research is needed. Such research could expand on different indication areas of NHP. If preferences (and related willingness to pay) for specific product attributes of NHP were to be analysed, such projects could, for example, conduct a conjoint-based choice experiment.

6.2 Discussion of the main findings

NHP are popular treatment options for healthy and ill people around the globe. They are used for many different indications. During the presence of the SARS-Covid-19 pandemic, which gave special salience to RD, NHP usage for RD indications was of particular interest for research and public institutions. Many scientific studies about CAM, and more specifically about NHP users and NHP usage during the pandemic were published for Arabic areas (Alyami et al., 2020; Syed et al., 2022; Zaidi et al., 2022). Some studies took up CAM, NHP or HM users and usage in European countries like Poland (Makowska et al., 2020; Puścion-Jakubik et al., 2021) or the Netherlands (Kristoffersen et al., 2022; Mulder et al.,

2022). However, little research was conducted within the German population, and on health behaviour changes regarding NHP since the pandemic. Günalan et al. (2021) analysed the popularity of biologically-based therapies among Google users inter alia in Germany (Günalan et al., 2021). Jeitler et al. (2023) researched on lifestyle interventions and self-care of complementary and integrative medicine during the pandemic in Germany (Jeitler et al., 2023). Another issue which affects humans across all ages and social classes are CC. Instead of investigating NHPCC users and usage, previous studies mainly focused on general neuro-enhancers rather than on natural based CC-products or they covered exclusively specific target groups like persons from universities (Mache et al., 2012), junior physicians (Mache et al., 2020), healthy (Franke, Bagusat, et al., 2014) or elderly individuals (Franke, Heinrich, et al., 2014). To the best knowledge of the PhD candidate, previous research has not addressed the investigation of individual and health behavioural factors that explain NHP usage in the general German population, especially for the two analysed indications of RD and CC. These research gaps, targeted by research question 1 were the starting point of this thesis, which focused on RD-NHP users on the one hand, and NHPCC users on the other.

Regarding RD-NHP users, the results of paper 1 showed that about 46.5% of the sample, equal to 54.2% of all NHP users in the past 12 months, indicated NHP usage for RD indications. Similar prevalence rates, determined during the Covid-19 pandemic, were for example found for HM usage targeting RD in Vietnam (49%) (Nguyen et al., 2021) and Saudi Arabia (48.5%) (Syed et al., 2022). With approximately half of NHP users using such products for RD, it shows their significance across cultures and nations. This thesis found that most RD-NHP users had no change in the amount of their used NHP products during the pandemic (82.4%). However, three times more RD-NHP users (13.2%) reported having used more NHP for RD indications since the beginning of the pandemic. Looking at the frequency of HM usage during the pandemic compared to before the pandemic, investigated by another study of the PhD candidate, the majority of HM users indicated no change in HM usage frequency. However, among those HM users who noticed a change in their HM usage frequency, more noticed an increase than a decrease (Wolf, Emberger-Klein, & Menrad, 2023). Among all NHP users, health support and maintenance were the most popular aims for NHP usage (overall 76.6%; RD-NHP user 79.1%), which might be an explanation as to why more users mentioned an increase in using NHP products during the pandemic.

Among NHPCC users, which were more closely investigated in paper 2, the share of individuals who aimed to use NHP for health support and maintenance was with 90.7% even higher than among RD-NHP users and significantly higher compared to nCC-NHP and past NHP users. Over the pandemic, supporting CC became more and more popular, as shown in a study in Poland. It determined an increase from a 2.5% prevalence of NHPCC usage in the first pandemic wave up to 8.4% in the third

pandemic wave (Puścion-Jakubik et al., 2021). In the study of this thesis the NHPCC-usage prevalence in the German population was 16.1%. Because of the variation in assessed products and different research sample characteristics, it is difficult to compare the findings of this thesis with previous studies (Tully et al., 2019). However, outside the frame of NHP but in the field of CC enhancement, Mache (2020) found that 18% of junior physicians and 8% of physicians in Germany have used stimulants for neuro-enhancement (Mache et al., 2020). Mache (2012) found phytomedicines with a prevalence of 22% the most common substances for CC enhancement among German students (Mache et al., 2012).

Regarding the first part of research objective 1, i.e. investigating the individual factors that explain NHP usage in different NHP user groups, both quantitative studies found higher shares of being female, young and having children living in the same household, as well as smaller shares for being aged 60 years or older for RD-NHP and NHPCC users (on a 12-month prevalence) compared to non- or past NHP users. Comparing the specific user groups (RD-NHP; NHPCC users) to the non-specific user groups (nRD-NHP; nCC-NHP users), it is notable that the amount of significantly different variables is much higher in the RD-NHP than in the NHPCC study. Only a smaller share of elderly people distinguished NHPCC users from nCC-NHP users, while several further predisposing factors such as being female, employed, having a higher education and having children living in the same household were significantly more present in the RD-NHP than nRD-NHP user group. This shows, that specific NHP users have distinct differences from other NHP users, depending on the indication. So as an example, the factor of having children living in the same household predicted RD-NHP from nRD-NHP usage (but not NHPCC from nCC-NHP usage), which might be due to the fact that children are especially vulnerable to RD infections (Turner, 1997; Zar & Ferkol, 2014).

Having suffered from a Covid-19 infection was an individual factor that predicted RD-NHP usage as compared to nRD-NHP usage. Further, having difficulties in daily attention and memory performance more frequently was a need factor that predicted NHPCC to nCC-NHP usage. Thus, the results of this thesis show that the occurrence of the health issue an NHP is targeting can be one predictor for the specific over the non-specific NHP usage. After the most popular aim of health support, the treatment of diseases and symptoms was the second most popular aim among RD-NHP users (77.6%), NHPCC users (70.8%) and nCC-NHP users (73.2%). Interestingly, NHPCC users had the highest share of individuals using NHP for illness prevention (69.1%). This aim was significantly higher than for nCC and past NHP users and also higher than for RD-NHP users (57.9%). One reason could be that up to date many CC diseases like dementia are, in contrast to many acute RD like the common flu, irreversible. Current research is examining natural and synthetic drugs for dementia (Dembitsky et al., 2020) and the disease prevention potential of diverse natural substances (Ullah et al., 2023). Neuro-supportive

potential was for example found in hops (Kirchinger et al., 2019; Riepl et al., 2018; Urmann et al., 2015; Wolf, Bayerl, et al., 2023; Wolf et al., 2022).

With regard to the second part of research question 1 concerning health behavioural factors that explain NHP usage, it is to mention that, as investigated in paper 1, no relationship was found between vaccination-related behaviour and NHP consumption. This finding is in contrast to other research that found individuals with a favour for NHP less likely to get vaccinated against Covid-19 (Meier et al., 2022; Reiter et al., 2020) or the flu (Di Bonaventura & Chapman, 2008). However, a study among older Australian women found that the usage of HM reduces the likelihood of influenza vaccination, whereas the consumption of vitamin supplements increased the likelihood of vaccinations (Wardle et al., 2017). More research is needed, to examine the multi-factorial and complex interface of CAM/NHP usage and vaccination behaviour.

Further health behavioural factors that were investigated for this thesis regarding a deeper explanation of NHP usage, were the information sources of NHP users about non-fatal health issues (paper 1) and about NHP (paper 2). The result of paper 2 showed that health professionals were the most mentioned NHP information source. Paper 1 is adding that health professionals, namely physicians and pharmacists, were also the most mentioned consultant for non-fatal health issues among the sample. Their consultation was a significant predictor for RD-NHP usage to nRD-NHP usage. Additionally, the consultation of pharmacists was a significant predictor for RD-NHP usage compared to non-NHP usage. These findings support previous research results, which highlight the importance of health professionals such as practitioners and pharmacists in health information distribution (Harnett et al., 2019; Olatunde et al., 2010; Ostermaier et al., 2020). Further, as found in paper 1, pharmacies were a common supply source for NHP. Consequently it is essential, that practitioners as well as pharmacists are provided with adequate educational training and evidence-based information regarding NHP, to ensure their capability to impart knowledge regarding NHP risk and safety issues as well as to encourage consumers to informed and safe decision-making, especially when they do so in self-medication (Blackburn et al., 2017; Farrell et al., 2008; Olatunde et al., 2010).

The second most mentioned information sources by NHP users of paper 2 was on-product information (e.g. declaration, which also occurred in the HVM of the qualitative study). Close to half of NHP users used on-product information as sources, which is more than German HM users reported to use before the pandemic (Welz et al., 2019). NHP are mainly available OTC and, as one result of paper 1, are bought by a majority of users in drugstores, which rarely provide personal NHP advice. As on-product information works without inter-personal exchange, their utilization might have risen due to legal contact restrictions and lockdowns during the Corona pandemic. Studies show that information

seeking behaviour changed during the pandemic, for example due to restrictions and uncertainties (Brown et al., 2022; Montesi, 2021).

Among cancer patients, studies found traditional print media also preferred to electronic media (Evans et al., 2007; Longo, 2005). Interestingly, in paper 2, gathering information via literature/journals was a significant predictor for NHPCC usage. This could be due to the indication field of CC. In some academic disciplines, CC enhancement is popular, as several studies among university students show (Dietz et al., 2013; McDermott et al., 2021; Sharif et al., 2022; Jahangeer et al., 2022). Universities usually provide easy access to literature and journals.

These major findings regarding information sources among different groups of NHP users may stand in relation to the topic of trust. In the qualitative study of paper 3 of this thesis, trust was found to be strongly associated with a conscious consumption decision. Making a conscious consumption decision was mentioned as being important for 92% of NHP users and linked to the gain of knowledge, an issue closely related to information sources. Previous research found that health professionals were the most trusted information source for HM, followed by family members and the package insert (Welz et al., 2019). Altogether, the findings of this thesis' work strengthen the important role of information and communication channels for NHP usage and decision-making, as discussed in the previous paragraphs. These insights into NHP information seeking sources can serve a better understanding of information behaviour during a health crisis and support policy makers and health communication experts to develop appropriate response strategies (Tangcharoensathien et al., 2020).

The next paragraphs discuss the major findings regarding value orientations of different NHP user groups (research question 2), values, which impact NHP decision-making as well as NHP users' association-chains between these values and product attributes (research question 3).

The quantitative studies of this thesis found self-transcendence being the strongest value-orientation related to NHP usage in the German population, followed by conservation, and openness-to-change. Self-enhancement was the weakest value orientation. This relation of value orientation strength mirrors the one previously found for the German population in general (Schwartz, 2007). Having a closer look to the major findings regarding research question 2, openness-to-change value orientations were significantly weaker among past- and non-NHP users than among all other NHP user groups in the study of this thesis. This result supports the assumption raising from previous studies, that openness is a typical value orientation of people who use CAM regularly (Ahola, 2020; Honda & Jacobson, 2005; Thomson et al., 2014). Additionally, both quantitative studies of the present work found self-transcendence value orientations to be significantly higher among the specific NHP user group (RD-NHP; NHPCC) than among the past-/non-NHP user groups. Only few previous studies

examined self-transcendence in relation to NHP usage, with Ahola (2020) also finding self-transcendence to be positively associated with CAM use. Self-transcendence was found as a resource for healing and source of well-being (Ahola, 2020; Coward & Reed, 1996), which aligns with the NHP usage aims as found in the studies of paper 1 and paper 2.

To explain the reasons why openness-to-change and self-transcendence were stronger value orientations in NHP users than in non-NHP users, a look at the results of the qualitative study (paper 3) may be helpful. Self-transcendence is based on the values of benevolence and universalism. Those values were served by environmental protection according to the findings reported in paper 3, which was associated with closeness to nature, making the attributes of sustainability and regionality important for the choice of NHP. Other research found similar results, with the attribute of naturalness being an important factor for NHP decisions (Boon et al., 2013) Additionally, consumers of medical plant products prefer ecologically certificated products when they placed importance on environmental protection (Amberg & Fogarassy, 2019). As found in the study of paper 2, self-transcendence was a predictor for NHPCC usage. A look to the HVM in paper 3 provides additional information by showing a connection between the self-transcendent orientated value of benevolence, a conscious consumption decision and the share of NHP usage experience. Benevolence represents the ambition for enhancing and maintaining the welfare of close people (Schwartz et al., 2012), which can be first hand and personally provided in individually shared information for example with family or friends.

Openness-to-change values which occurred in the findings of paper 3 were self-direction and stimulation. Especially self-direction, the ambition of independent thought and action (Schwartz, 2012), might facilitate self-medication. The studies of this thesis found that 83.6% of NHP users took NHP self-medicated. 89% of RD-NHP and NHPCC users and 87% of nCC-NHP users indicated self-medication with NHP. These self-medication rates were higher than the ones found for NHP usage at the beginning of the pandemic in other European countries, namely Norway (72.8%), the Netherlands (59.4) and Sweden (50.0%) (Kristoffersen et al., 2022). A review study found prevalence rates for self-medication related to Covid-19 reaching from 3.6% to 96%, depending on the study populations (Ayosanmi et al., 2022). The result of this thesis' study places itself on the higher end of that range, but its focus is not only on Covid-19 and rather includes RD in general. The fact that less than one third of self-medicating RD-NHP users reported this behaviour to their practitioner should be alarming, because consumers might underestimate risks and interactions of NHP with other therapies, including the ones under medical supervision (Eichhorn et al., 2011; Komolafe et al., 2021).

In this context, taking the results of the laddering-study of paper 3 into account which address research question 3, one association chain that levelled up to the value of self-direction traced inter alia back

to the attribute of tolerance that more than half of the participants of the qualitative study mentioned in association with NHP. One issue with NHP self-medication that was frequently discussed in literature (Alghanim, 2011; Amm et al., 2022; Ayosanmi et al., 2022; Brandão et al., 2020; Eichhorn et al., 2011; Kıroğlu et al., 2022; Malik et al., 2020; Masumoto et al., 2023), is the lack of risk-awareness, especially concerning an underestimation of potential NHP side effects and interactions with drugs. This issue could be addressed by an optimization of NHP health communication and information strategies. To the best knowledge of the PhD candidate, such research as published in paper 3 has not been conducted previously. Thus, this knowledge provides a valuable contribution to research on NHP users in Germany.

Effectiveness was the most mentioned choice relevant product attribute for NHP, linked to several other product attributes like ingredients or organoleptic properties and strongly associated with wellbeing. However, Boon et al. (2013) found that for NHP sleep aids, effectiveness was only under special circumstances more important than the attributes of naturalness and perceived better tolerance (Boon et al., 2013). Perceived benefits resulting from positive effects were also found to be choice relevant, for example, for natural functional food (Rezai et al., 2017). A study among adult Canadians found, that most individuals were neutral to whether prescription medicine had more effectiveness than NHP. The ones who denied that prescription medicine is more effective than NHP seemed to base their evaluation on personal experience (Barry, 2018).

7 Conclusion

The determined high prevalence rates for NHP usage in general, and in particular for RD-NHP and NHPCC usage, highlight the ongoing and raising popularity of NHP in the German population, especially for health support and maintenance. This thesis identified individual and health behavioural factors that explain NHP usage, especially regarding RD-NHP and NHPCC. Results showed that the occurrence of the health issue targeted by the NHP, such as a Covid-19 infection in the case of RD and DAMP for CC, was one significant predictor for RD-NHP and NHPCC use as compared to the other (nRD/nCC) NHP user group. Individuals who had a Covid-19 infection, were employed, and consulted pharmacists for non-fatal health issues were more likely to use RD-NHP. In contrast to other research findings, this thesis study found no relation between NHP usage and vaccination behaviour, which should embolden further research to re-examine assumptions concerning vaccination behaviour and NHP usage. NHPCC users were less likely older than 60 years, had more often difficulties in daily attention and memory performance, and were more likely to use literature and journals for NHP information seeking than nCC and past NHP users. Such information can help to define target groups for new and innovative NHP, market launch and marketing campaigns. As the predictors for NHP usage can differ depending on the indication, there is a need for more research on NHP users and usage for further indications that affect healthy and symptomatic people, like for example sleep problems.

Health professionals, including practitioners and pharmacists, were the most important NHP information source; general practitioners additionally presented the most frequented consulting source regarding non-fatal health issues. Thus, they play an important role for high quality NHP information distribution to enable consumers to informed decision-making, especially under consideration of the common habit of self-medication. To support health professionals in their role and responsibility to consult informed NHP self-medication, NHP should be a mandatory aspect of their vocational training as well as ongoing training and information opportunities to updated knowledge should be provided in this field. Furthermore, the training should take into account and raise the awareness of the impact of values and value orientations on healthcare and NHP decision-making, including the impact of own values when giving advice and, in particular, the values of the individuals who ask for advice.

The results of this work strengthen the assumption that NHP users have strong openness-to-change value orientations. Universalism and benevolence were found to be linked to consumers who give high relevance to NHP attributes regarding sustainability in the choice process. This connection received little attention in previous research and leaves a gap yet to be analysed further in future research. Self-transcendence was found to be stronger in RD-NHP and NHPCC users than in past/non-NHP users. Values of self-direction and stimulation were linked to high importance of knowledge and a conscious

consumption decision, which was associated with the effectiveness, tolerance and declaration of the NHP. In consideration of which NHP attributes matter for the consumer and why this is the case (associated consequences and linked values), health professionals can provide NHP healthcare options along the consumers values. This can facilitate informed, independent and satisfactory decision-making by the consumer, leading to better and therefore safer utilization of NHP. The common use of NHP in self-medication in combination with the frequent notion of purchasing NHP in drugstores, which usually do not provide personal advice on the sold products, as the most common supply source lend credence to the product itself as an important information source for consumers. It is crucial for NHP manufacturers and politicians to provide relevant information requested by the consumers in an adequate and comprehensive way as well as to set the legal frame for such practices. The results of this work can be used to develop and optimize healthcare strategies and support safe and informed NHP utilization.

Decision-making on NHP is a complex process with many influencing factors. There are some factors that indicate NHP usage in general, others depend on the indication the consumer is targeting with the NHP. This works makes an important contribution to the understanding of NHP usage, in particular for the indications of RD and CC, by having examined individual and health behavioural factors that explain NHP usage, and the role of value-orientations. It further contributes to the understanding of NHP decision-making, by uncovering the linkages between choice relevant NHP attributes and life-guiding values of the cognitive choice process. The chosen approach of using data-driven quantitative methods and the consumer-centred MEC-method allowed macro and micro level insights to NHP usage and decision-making in Germany. It provides a ground for future research on CAM and NHP consumers, either on general or on specific indications. Comparable studies conducted in other cultures would enable finding international similarities and differences regarding NHP usage and the cognitive process of decision-making. The inclusion of values or value-orientations in healthcare models is, as demonstrated in this thesis, appropriate and advisable.

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Appendices

Appendix A: Online-survey questionnaire excerpt

Questions relevant for the studies *"Usage of Natural Health Products (NHPs) for Respiratory Diseases: User Characteristics and NHP-Consumption Behavior during the Covid-19 Pandemic in Germany"* (Paper 1) and *""Factors influencing the use of Natural Health Products, in particular for concentration and cognition in Germany"* (Paper 2)

Quotation-Questions

How old are you?

- 18-29
- 30-39
- 40-49
- 50-59
- 60 years +

What is your gender?

- male
- female
- divers

In which federal state is your residence?

- o Bavaria
- o Baden-Wuerttemberg
- o Berlin
- o Brandenburg
- o Bremen
- o Hamburg
- o Hesse
- o Mecklenburg-Western Pomerania
- o Lower Saxony
- o North Rhine-Westphalia
- o Rhineland-Palatinate
- o Saarland
- o Saxony
- o Saxony-Anhalt
- o Schleswig-Holstein
- o Thuringia

How many people live in your residence town?

- less than 5.000
- 5.000 to <20.000
- 20.000 to <100.000
- 100.000 to <500.000
- 500.00 or more

PART 1: NHP consumption

Which natural health products have you ever used? (multiple answers allowed)

- prescriptive herbal medicine
- over the counter herbal medicine
- foods declared as supporting health (e.g. juices)
- natural nutritional supplements
- herbal homeopathic remedies
- other: _____
- I have never used natural health products. *(exclusive answer/no other answer possible → skip to part 2)*

Have you used natural health products during the past 12 months for your own health or illness?

Natural health products include all products that are made from natural ingredients and aim to have a positive impact on health and well-being. These include herbal medicines, natural nutrition supplements and preparations from plants such as health teas.

- yes
- no

For which of the following health problems have you *ever* used natural health products to treat diseases/symptoms or support your health? (multiple answers allowed)

- Common cold/flu infection
- Covid-19
- Cough
- Insomnia
- Anxiety/restlessness
- Depression
- Concentration/Cognition
- Dementia
- Headaches/migraines
- Pain
- Tinnitus
- Blood pressure
- other: _____

For which of the following health problems have you used natural health products *in the last 12 months* to treat diseases/symptoms or support your health? (multiple answers allowed)

- Common cold/flu infection
- Covid-19
- Cough
- Insomnia
- Anxiety/restlessness
- Depression

- Concentration/Cognition
- Dementia
- Headaches/migraines
- Pain
- Tinnitus
- Blood pressure
- other: _____

Which of the following is/are your goal/s for the consumption of natural health products? (multiple answers allowed)

- Health support/ maintenance
- Disease prevention
- Diseases/symptom treatment

Have you also used natural health products in self-medication in the last 12 months without prescription or recommendation by a physician?

- yes
- no

Have you informed your general practitioner or health care provider about your use of natural health products in self-medication?

- yes
- no

How did your consumption of natural health products change since the beginning of the Covid-19 pandemic in Germany?

I take…

- more
- the same amount of
- fewer

…natural health products than before the pandemic.

Do you use natural health products that you did not use before the Corona pandemic?

- yes
- no

Where have you obtained natural health products within the previous 12 months? (multiple answers allowed)

- Pharmacy
- Drugstore (e.g. dm, Rossmann, Müller)
- Selfgrowth or self-collection
- Internet/Onlineshops
- Familiy/Friends
- other: _____

Where do you inform yourself about the effectiveness and possible areas of application of natural health products? (multiple answers allowed)

- General practitioner
- Alternative practitioner
- Pharmacist
- By trial and error
- On product
- Literature/journal
- Family/Friends
- Online/Social Media
- other: _____

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PART 2:

Health Condition and Health Behavior

In the following section, you will now be asked questions about your general health and health behavior.

Please answer all questions conscientiously and honestly. There are no right or wrong answers. All data in this survey is collected anonymously, which means that no conclusions can be drawn about you personally.

How do you rate your general health condition?

- Very good
- Good
- Medium
- Bad
- Very bad

Do you suffer from one or more long-term (longer than 6 months) health issues or chronic diseases?

(Note: Chronic diseases are long-durative diseases, which require ongoing treatment and control, for example diabetes, arthroses, migraine, hay fever, asthma, irritable bowel syndrome, psychological diseases, attention deficit disorder)

- No
- Yes

Who do you consult if you have (non-life-threatening) health complaints? (multiple answers allowed)

- General practitioner
- Pharmacist
- Alternative practitioner
- Family
- Friends
- Nobody
- other: _____

Please select whether or not the following statements apply to you:

- Within the last 12 months, I have received a flu vaccination.
- Within the last 6 months, I have received a Covid-19 vaccination.
- My tetanus vaccination is up to date.
- I join the recommended preventive medicinal check-up (e.g. cancer screening, birthmark control …).

Have you had a positive Covid-19 test result within the previous 6 months?

- yes
- no

Attention and Performance Self –Assessment (APSA)

The following questions are about situations that can occur to everybody by times, or about little mistakes which can happen to everyone. Some happen more regular than others. We want to know, how often did they occur by you within the past 4 weeks?

Please indicate the answer (never – seldom – sometimes – often – always) which fits best for you.

Description	Never	Seldom	Sometimes	Often	always
Do things not intended to					
Sound disturb reading					
Make mistakes if low effort					
Concentrate short period					
Can't express/tip of tongue					
Difficult follow conversation >1 talking					
Daydream instead of listen					
Distracted by sounds when tired					
No point start task when weighing on mind					
Impatient at work					
Act differently than planned					
Sudden forgetfulness					
Mistake easily when tired					
Forget appointments					
Can’t find things					
Return home after forgot things					
Difficult follow conversation talking quickly					
Read repeatedly					
Wonder whether use word correctly					
Mind wandered					
Satisfied with concentration					

Short Schwartz Value Survey (SSVS)

Please read through the following values and their descriptions.

Then tick how important these values are for you personally.

Value	Against my values	Not important at all	Not important	Rather not important	Rather important	Important	Of supreme importance
Power: social status and prestige, control or dominance over people and resources							
Achievement: Personal success through demonstrating competence according to social standards							
Hedonism: Pleasure and sensuous gratification for oneself							
Stimulation: Excitement, novelty, and challenge in life							
Self-Direction: Independent thought and action, choosing, creating, and exploring							
Universalism: Understanding, appreciation, tolerance, and protection for the welfare of *all* people and of nature							
Benevolence: Preservation and enhancement of the welfare of people with whom one is in frequent personal contact							
Tradition: Respect, commitment, and acceptance of the customs and ideas that traditional culture or religion provides							
Conformity: The restraint of actions, inclinations, and impulses that are likely to upset or harm others and violate social expectations or norms							
Security: Safety, harmony, and stability of society, relationships, and self							

Sociodemographic data

What is your highest educational achievement?

- Without graduation
- Secondary modern school or equivalent
- Graduation from polytechnical school in GDR
- School leaving graduation
- Bachelor
- Diploma
- Master
- Ph.D.
- Alternative degree:_____

How is your occupation status?

I am…

- Full-time employed
- Part-time employed
- Partial retirement
- Marginally employed
- Not employed (including pupils or students, job seekers or unemployed, early retirees, pensioners)
- In vocational training
- Retirement
- Federal voluntary service/voluntary social year
- Maternity, parental leave, parental leave

How many people live permanently in your household, including yourself?

This includes all persons with whom you live and manage together.

- One person
- More than one person

Counting me in, ___ people are living in my household, including ___ children aged under 18 years.

Please indicate your health insurance:

- No health insurance
- Public health insurance, voluntary
- Public health insurance, mandatory
- Public health insurance plus additional private insurance
- Private health insurance
- Family health insured
- Other (e.g. Federal Armed Forces, civil servants)

Appendix B: Interview guideline excerpt

Entrance

- Which natural health products do you use and have you used? What is your experience with this products?
- Do you use or have you used natural health products for the indication of concentration or cognition?
    - If yes: When? Which ones? Why?

Scribble

- "Imagine you have the chance to create a natural health product with a new herbal extract. Studies prove the extract can have a positive impact on the neuronal system. It has the potential to support or might even to improve concentration and cognition. You can design this product to your personal preferences.

  Please describe which attributes of the product would be important for you. How should the product be like? Which characteristics, visible and non-visible are important for you?"

The interviewer scribbles the thoughts the participant mentioned on a whiteboard. The participant can comment on the scribble to optimize and reinsure, the scribble reflects what he/she has in mind. Scribbles includes pictures and words.

At the end of this section, the interviewer summarizes the mentioned attributes and writes them on cards. The participant ranks the attribute-cards according to their personal importance in natural health product decision-making.

Laddering

Starting with the highest ranked product attribute, the laddering procedure begins. After finishing one ladder, the next starts with the second highest ranked attribute.

- Why is this important for you?

Or

    - *What do you associate with xx?*
    - *What is the consequence you expect from xx?*
    - *What is the impact of xx for you?*
    - *…*

Ending

- Do you have further thoughts concerning the topics risen in the interview? If so, you are free to mention them now.

Appendix C: Final code system (MEC-study)

Element Code	Definition
Attributes	
Declaration	Transparent presentation of information about effectiveness, product handling and safety
Effectiveness	The product works and change/effect a state within a given time
Ingredients	Resources and their composition; naturalness; without toxic and artificial additives
Organoleptic Properties	Sensory perception: Taste, smell, and texture
Price-Performance	Relation between monetary costs and individual benefits
Regionality	Origin of the ingredients and/or production close to the purchase location
Sustainability	Conscious long-term orientated social and ecological actions within the whole supply chain
Tolerance	Few or no side effects and interactions with other drugs; no allergic reactions
Consequences	
Agility	Ability of body movements without physical restrictions, pain or other discomforts
Charisma	Appearance and effect of individuals on the people around them
Closeness to Nature	Feeling in unity with the rural environment and the ecological system of the earth
Conscious Consumption Decision	Ability to choose freely between options among a product class based on relevant information and satisfactory knowledge
Energy	Power and ability to perform and fulfil tasks or desired workload of activities
Gain Knowledge	Learn from advice, instructions, reports and other kinds of spoken or written information
Good mood	Joy; happiness; feeling happy; being more than "just" satisfied
Mindfulness	Conscious perception and appreciation of the environment and the self; joy for the little
Self-Care	Self-responsibility for the own physical, mental and social state
Share Experience	Give information about what one has learned in and from life to others
Trust	Believe in their credibility and reliability of information, taking promises for granted
Well-being	Feeling mentally and physically comfortable; to have less or no worries, being carefree
Work-Life-Balance	Fair share between workload and worktime to leisure and recovery time
Values	
Belonging	Social integration, companionship, good social relationships
Benevolence	Preserving and enhancing the welfare of those with whom one is in frequent personal contact
Environmental Protection	Nature conservation, climate protection
Health	State of physical, psychic, and social wellbeing
Security	Safety, harmony, and stability of society, of relationships, and of self
Self-Direction	Independent thought and action; choosing, creating, exploring
Self-Realization	Personal development, building strength, skills, personality, and character
Social Justice	Fairness; respect for human dignity and human rights
Stimulation	Excitement, novelty, and challenge in life
Universalism	Appreciation, tolerance, and protection for the welfare of all people and nature

Appendix D: Full version of the published papers

This Appendix includes the full versions of the following papers:

Paper 1) Wolf, M., Emberger-Klein, A., & Menrad, K. (2023). Usage of Natural Health Products (NHPs) for respiratory diseases: user characteristics and NHP-Consumption behavior during the Covid-19 pandemic in Germany. *BMC Complementary Medicine and Therapies*, *23*(1), 372.

Paper 2) Wolf, M., Emberger-Klein, A., & Menrad, K. (2024). Factors influencing the use of natural health products, in particular for concentration and cognition in Germany. *BMC Complementary Medicine and Therapies*, *24*(1), 103.

Paper 3) Wolf, M. E., Emberger-Klein, A., & Menrad, K. (2024). From consumer values to attributes of natural health products for concentration and cognition: insights from a means-end-chain study. International Journal of Pharmaceutical and Healthcare Marketing, 18(1), 148-166.

All of these papers were conducted as part of this thesis and published in peer-reviewed journals.