

ORIGINAL ARTICLE

Phytotherapy in spa treatment: knowledge, use and opinions of spa patients, visitors and residents of a spa town (Inowrocław, Poland)

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ABSTRACT

Introduction: Herbal medicine is among the oldest therapeutic traditions and is deeply rooted in European spa culture, most fully expressed in the system of Sebastian Kneipp. In Polish spas, however, phytotherapy is used only marginally, and public knowledge of medicinal plants is fading.

Aim: To assess the knowledge of phytotherapy and attitudes towards its use in spa treatment and in self-treatment among spa patients, visitors and residents of the Polish spa town of Inowrocław, answering five research questions with five research and five statistical hypotheses.

Material and Methods: A diagnostic survey with an original closed-ended questionnaire was carried out on 19 May 2013 near the brine graduation towers in Inowrocław (58 valid questionnaires; 41 women, 17 men; 28 spa patients, 18 visitors, 12 residents). Group-level results were converted from the thesis charts into whole-person counts and analysed with descriptive statistics, Clopper-Pearson confidence intervals, exact binomial tests, Freeman-Halton and Fisher exact tests with Holm correction, and correspondence analysis. Methods that need individual-level data (canonical, discriminant, cluster and factor analysis) could not be applied.

Results: Only 13 of 57 respondents (22.8%; 95% CI 12.7-35.8) had ever used phytotherapy in a spa, and a physician had never proposed herbal treatment to 40 of 58 (69.0%; 95% CI 55.5-80.5). Herbs were nevertheless used on their own by 35 of 46 spa patients and visitors (76.1%). Of 57 respondents, 46 (80.7%; 95% CI 68.1-90.0) wanted herbal medicine promoted more and 46 (80.7%) favoured extending it in spas; nobody opposed either proposal. Residents more often did not know herbs (8/12 vs 4/27 spa patients and 5/18 visitors; exact $p = 0.006$), but this did not remain significant after correction for 14 comparisons (adjusted $p = 0.078$). Only the preparation of home-made cosmetics differed significantly between groups after correction (adjusted $p = 0.009$; Cramér's $V = 0.48$). Correspondence analysis described two dimensions (60.6% and 39.4% of inertia) that separated residents, spa patients and visitors.

Conclusions: Phytotherapy is rarely used in Polish spa medicine despite clear social demand. Evidence-based health education, careful integration of herbal treatment into spa programmes under medical supervision, and larger multi-centre studies with individual-level data, which would allow multivariate analyses, are recommended.

KEYWORDS: Phytotherapy, herbal medicine, spa treatment, balneology, Kneipp therapy, health education

1. Introduction

Long before modern pharmacology existed, people treated themselves with what nature provided. Records from Egypt, China, India and Mesopotamia show that medicinal plants were the basis of therapy well before the first pharmacies (Brinkmann et al., 2007; Lamer-Zarawska et al., 2012). The foundations of European herbal medicine were laid by Hippocrates, Theophrastus, Dioscorides and Galen, and in the Middle Ages the knowledge was preserved mainly in monasteries. In Poland, the herbals of the Brothers Hospitallers and the work of Fr. Czesław Klimuszko in the twentieth century reminded the public what rational herbal medicine can offer (Klimuszko, 1987; Książkiewicz, 1997). Renaissance Polish herbals combined Galenic medicine with the native folk tradition (Szostak, 2006).

Contemporary phytotherapy is no longer purely traditional herbalism. It is a branch of pharmacology and pharmacotherapy that uses plant raw materials and extracts with documented activity (Matławska, 2020; Samochowiec et al., 2002). In contrast to synthetic drugs, plant preparations contain whole sets of active compounds that act in a complex and, as a rule, milder way, usually with fewer adverse effects. The development of organic chemistry in the nineteenth century and of synthetic drugs in the twentieth century pushed herbs to the margin of official medicine, yet they never disappeared from home practice. The

growing list of adverse reactions to synthetic drugs is one reason why patients, and increasingly physicians, are returning cautiously to plant-based therapy. Natural raw materials are also returning to pharmacy, cosmetology and aesthetic medicine, where plant and microbial ingredients (algae, fungi) attract interest for their therapeutic, cosmetic, hygienic and prophylactic properties (Czerpak & Jabłońska-Trypuć, 2008; Fink, 2007).

An important element of the European safety framework for phytotherapy is Directive 2004/24/EC of 31 March 2004. It introduced a simplified registration procedure for traditional herbal medicinal products and established the Committee on Herbal Medicinal Products (HMPC) at the European Medicines Agency (European Parliament & Council of the European Union, 2004). A long tradition of use reduces the need for clinical trials where efficacy is plausible on the basis of long-standing use, but the full quality requirements, in line with pharmacopoeial monographs, remain in force.

Spa treatment is by nature complex: several methods are applied simultaneously because they reinforce one another (Ponikowska et al., 1995; Ponikowska, 2012). Besides balneotherapy, peloid therapy, climatotherapy, hydrotherapy, kinesitherapy, physical therapy, diet, health education and pharmacotherapy, phytotherapy is among the methods used in spas. Its systematic place in this arrangement was defined by Sebastian

Kneipp (1821-1897), a Bavarian priest working in Bad Wörishofen, whose concept rests on five pillars: hydrotherapy, exercise, nutrition, herbs and regulative therapy (order of life) (Locher & Pforr, 2014).

Poland presents a paradox. Despite a rich native herbal tradition, phytotherapy is practically absent from Polish spas, whereas in some European countries, above all Germany, it remains a regular element of therapeutic and preventive offers (Locher & Pforr, 2014; Ponikowska, 2012). At the same time, the intergenerational transmission of knowledge about herbs is fading: what grandmothers once knew increasingly escapes their grandchildren.

2. Aim of the study

The aim of the study was to assess the knowledge and opinions of spa patients, visitors and residents of Inowrocław regarding phytotherapy. In particular, we asked: (1) whether and to what extent herbal medicine is used in spa treatment and in self-treatment; (2) what is the level of knowledge about the effectiveness of phytotherapy and its presence in spas in Poland and Europe; (3) where respondents obtain their knowledge about herbs; and (4) whether there is a demand for phytotherapy in spa treatment.

The main hypothesis assumed that phytotherapy in Polish spas is rarely encountered and that knowledge of herbs is minimal. The specific hypotheses assumed that: spa patients' knowledge of herbs is limited; herbal medicine is not promoted; it is

difficult to obtain reliable knowledge; the proportion of people using phytotherapy is low; physicians rarely propose herbal treatment; and knowledge of herbs is related to age.

3. State of knowledge

3.1. Phytotherapy: definitions, raw materials and dosage

Phytotherapy (from Greek *phyton*, plant, and *therapeia*, treatment) is the treatment of disease with agents of plant origin: herbal raw materials and preparations made from them (Matławska, 2020; Samochowiec et al., 2002). Almost any part of a plant can serve as a raw material (herb, leaf, flower, fruit, seed, bark, rhizome or root), fresh or dried. Its therapeutic value depends not only on the species but also on the habitat, the time of harvest (hence the traditional herb-harvesting calendar), and the way of drying and storage (Dobrowolski et al., 1955; Schilcher & Dorsch, 2010). The most common forms of herbal medicines are teas and mixtures (infusions and decoctions), tinctures, herbal wines, essential oils, syrups and juices, and, for external use, compresses, wraps and additives to baths and inhalations. From a pharmacological point of view, medicinal plants are classified according to their dominant active compounds. Alkaloid-containing raw materials act on the central nervous system; glycosides act, for example, on the heart or as laxatives; flavonoids protect blood vessels and act as antioxidants; tannins are astringent and anti-

inflammatory; essential oils are bactericidal and expectorant; and mucilages protect the mucous membranes of the digestive and respiratory tracts (Dobrowolski et al., 1955; Samochowiec et al., 2002). This classification is simplified, but it allows herbs to be matched consciously to complaints.

Herbs are not harmless teas. Their active compounds (alkaloids, glycosides, flavonoids, tannins, essential oils, mucilages, phenolic acids) can have a very strong biological effect, interact with synthetic drugs and cause harm when dosed incorrectly (Samochowiec et al., 2002; Schilcher & Dorsch, 2010). Some herbs reduce the effect of synthetic drugs, and others increase the risk of bleeding when combined with anticoagulants. Careless replacement of conventional treatment with herbs in diseases that require medical intervention is also dangerous. For these reasons, rational phytotherapy should take place under the supervision of a physician or pharmacist, as emphasised by clinical textbooks (Schilcher & Dorsch, 2010) and by EU legislation (European Parliament & Council of the European Union, 2004). Quality of raw material is a separate issue. Herbs from one's own harvest should come from areas away from roads and industrial crops,

be collected at the proper time and dried correctly; mistakes at any of these stages can deprive the raw material of therapeutic value or make it harmful (Dobrowolski et al., 1955; Schilcher & Dorsch, 2010). This is why Directive 2004/24/EC makes simplified registration conditional on full quality documentation (European Parliament & Council of the European Union, 2004).

3.2. Herbs in spa treatment: the Kneipp system

Spa treatment has a complex character: the simultaneous use of several methods increases the effectiveness of therapy, and some combinations are particularly beneficial, for example thermal, light or cryotherapeutic procedures followed by kinesitherapy, or underwater massage and pearl baths after exercise to accelerate post-exertion recovery (Ponikowska et al., 1995; Ponikowska, 2012). Among the basic methods of spa treatment (balneotherapy, peloid therapy, climatotherapy, hydrotherapy, thermotherapy, kinesitherapy, physical therapy, diet, health education, psychotherapy and pharmacotherapy; Table I), phytotherapy closes the list, but is by no means the least important (Ponikowska, 2012).

Table I. Methods of spa treatment

Method	Characteristics
Balneotherapy	Treatment with natural mineral waters; together with peloid therapy and climatotherapy, one of the most important methods, determining the therapeutic profile of a spa
Peloid therapy	Treatment with peat (mud) from a well-studied deposit: compresses, wraps, peat baths, tampons, peat paste
Climatotherapy	Use of the natural environment for treatment: sun and air baths, sea baths, inhalation of sea or graduation-tower aerosol, thalassotherapy, landscape values
Hydrotherapy	Plain water of various temperature and pressure: showers, whirlpool baths, underwater massage, pearl

	baths; used in neurological, orthopaedic and rheumatic diseases, peripheral circulatory disease and hypertension
Thermotherapy	Heat and cold procedures, often followed by kinesitherapy
Kinesitherapy	Treatment with various forms of physical activity of appropriately chosen load: passive, assisted and resisted exercises, coordination and gait training, individual and group exercises in water
Physical therapy	Electrotherapy, phototherapy, ultrasound, thermo- and cryotherapy
Diet	An obligatory part of the programme in digestive diseases, diabetes, osteoporosis, atherosclerosis and gout
Health education	Shaping proper eating habits, giving up addictions and increasing physical activity; should be part of each programme
Psychotherapy	Relaxing psychological, sociological and natural environment that supports treatment
Pharmacotherapy	Not rejected by modern spa medicine; treated as one of the methods used under spa supervision
Phytotherapy	Herbal teas, additives to baths, compresses and inhalations, dietary supplementation, under medical control

Source: compiled from (Ponikowska et al., 1995; Ponikowska, 2012).

Herbs were most fully integrated into spa treatment by Kneipp's concept. It is a holistic system that counteracts the pathogenic effects of civilisation and restores psychophysical balance by activating the body's reserve capacity, training its regulatory and defence mechanisms, and normalising basic functions such as sleep, metabolism, breathing and circulation (Locher & Pforr, 2014; Ponikowska, 2012). For more than thirty years Kneipp treated patients with plant remedies with good results, relying on oral tradition and his own experience. He used plants from the sub-Alpine meadows and from his own monastery garden, preparing teas, juices, herbal wines, tinctures, oils and powders. He encouraged the consumption of honey, resin syrup, onion, garlic, cod-liver oil, oat drink, sauerkraut, radish juice, raspberries and pine needles. He also prescribed walks among

herbs, noting the beneficial effect of essential oils and aerosols on the respiratory tract long before the concept of inhalation therapy entered medicine.

In the modernised version of Kneipp's method, developed by physicians and pharmacists, plants are used in forms close to the original: hay compresses, additives to washings, wraps and compresses, water and steam baths, inhalations, medicinal teas, and dietary supplementation. The herbal cure is always supervised by a physician, and the tea is prescribed and entered in the patient's cure booklet on a par with other forms of treatment (Locher & Pforr, 2014; Ponikowska, 2012). The most frequent plant additives used in hydrotherapy by the Kneipp method are listed in Table II. Their role in Kneipp balneology has also been reviewed in the German phytotherapy literature (Uehleke, 2011).

Table II. Plant additives most frequently used in hydrotherapy by the Kneipp method

Herbal additive	Type of procedure	Composition and pharmacological properties	Indications
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Arnica (<i>Arnica montana</i>)	baths, wraps, rubs, compresses	Sesquiterpene lactones, fatty acids, thymol, flavonoids; analgesic, anti-inflammatory, disinfectant; accelerates resorption of effusions and haematomas	Pain in the limbs after overexertion, contusions (alcoholic extracts, external use)
Oak bark (<i>Cortex Quercus</i>)	full and limb baths, compresses, washings	Tannin: astringent, bactericidal, anti-inflammatory; resin	Ulcers and suppurating wounds, skin mycosis, rinsing of mouth and throat, frostbite
Pine shoots (<i>Turiones Pini</i>)	baths, inhalations, steam baths	Turpentine with soothing and disinfecting action, resin acids; locally spasmolytic and warming	Upper respiratory tract catarrh, colds, rheumatic pain and neuralgia
Hay, grass seeds (<i>Semina graminis</i>)	baths, inhalations, steam baths, wraps, hay bags	Organic acids, essential oils, glycosides, enzymes; calming, relaxing, hyperaemic, spasmolytic	Soft-tissue rheumatism, arthritis and bronchitis, back pain, autonomic neurosis, fatigue
Chamomile (<i>Chamomilla recutita</i>)	baths, sitz baths, inhalations, wraps, compresses, washings	Essential oils, glycosides, flavonoids, coumarins, mucilages; disinfectant, spasmolytic, anti-inflammatory	Dermatological problems and skin diseases, burns, pressure sores, haemorrhoids
Rosemary (<i>Rosmarinus officinalis</i>)	full, 3/4 and half baths	Essential oils, flavonoids, tannins, rosmarinic acid; antiseptic, antispasmodic, hyperaemic, stimulating	Circulatory disorders, climacteric complaints, rheumatic disorders
Sage (<i>Salvia officinalis</i>)	baths	Flavonoids, resin, bitter principle, tannins, essential oils; antiseptic, anti-inflammatory, antifungal	Eczema, poorly healing wounds, colds, excessive sweating, digestive disorders
Horsetail (<i>Equisetum arvense</i>)	baths, compresses, wraps	Silicic and oxalic acids, flavonoids, minerals; soothing, bactericidal, anti-inflammatory	Leg ulcers, poorly healing wounds, eczema, contusions, burns
Thyme (<i>Thymus vulgaris</i>)	compresses, wraps, inhalations, steam baths, washings	Flavonoids, tannins, phenolic acids, volatile oils; expectorant, disinfectant, spasmolytic	Respiratory infections, chronic bronchitis, leg ulcers

Source: compiled from (Locher & Pforr, 2014; Ponikowska, 2012).

A living monument of this tradition is the Sebastianum rehabilitation clinic in Bad Wörishofen, founded in 1890 by Kneipp himself, where treatment by his method has been continued without interruption for more than 150 years. Herbal extracts are added to warm compresses and wraps there, in colds mixed with a little alcohol, while vinegar, salt, linseed, quark, milk powder and sauerkraut juice are used for cold procedures (Table III). Procedures are performed in

patients' rooms early in the morning, between 5 and 7 a.m., and last from about 45 minutes to 2-3 hours (Ponikowska, 2012). Hay compresses, called the morphine of nature cure, are particularly well known: a linen bag filled with hay from the May mowing is warmed over steam to about 45 °C and applied to the painful area. The procedure is analgesic and is used in neuralgia, back pain, muscle tension, menstrual disorders and rheumatic complaints.

Table III. Selected additives used in hydrotherapy procedures at the Sebastianum clinic in Bad Wörishofen

Type of procedure	Additive and indications
Warm baths: full, 3/4 and half baths	Lemon balm: calming and relaxing; hay flower: rheumatic disorders; chamomile: dermatological problems; rosemary: circulatory diseases
Inhalations and steam baths	Thyme extract: respiratory insufficiency, persistent cough, retained secretions; pine needle oil: upper respiratory tract diseases

Sitz baths	Alternating-temperature oak-bark bath: haemorrhoids; warm horsetail bath: prostate diseases
Cold wraps of the lower limbs	Solutions of linseed, milk powder, sauerkraut juice, quark, wine vinegar; table salt added in bacterial infections and limb circulatory disorders
Warm wraps of the trunk and limbs, washings	In colds: extract (40% ethanol) of meadow flowers and thyme; Retterspitz mixture (arnica extract, rosemary and thyme oils, alum): suppurating wounds, leg ulcers

Source: compiled from (Ponikowska, 2012).

Honesty requires adding that, although the Kneipp system has a long tradition and numerous clinical observations, high-quality randomised trials are still scarce. A recent systematic review found no study that tested Kneipp therapy or any of its pillars as a whole (Reisecker et al., 2026), and earlier reviews and expert assessments likewise call for rigorous evaluation of the individual components (Ehnert & Geiser, 2022; Stier-Jarmer et al., 2021). Cohort data nevertheless suggest benefit of a complex Kneipp cure: in a one-year follow-up of patients treated with a standardised combination of hydro-, kinesi- and phytotherapy, diet and regulative therapy, pain, subjective complaints and drug consumption improved significantly (Leuchtgens et al., 1999).

3.3. Selected medicinal plants

A handful of plants return again and again in home and spa phytotherapy. Aloe (*Aloe vera*) regenerates, moisturises and acts as a bactericide, which gave it a permanent place in dermatology and cosmetology (Bassetti & Sala, 2005; Mikołajczak, 2018). Chamomile (*Chamomilla recutita*) is disinfectant, anti-inflammatory and spasmolytic; stinging nettle (*Urtica dioica*) is a tonic that supports metabolism; onion (*Allium cepa*) is bactericidal and expectorant; sage (*Salvia officinalis*) is antiseptic; ribwort plantain

(*Plantago lanceolata*) protects mucous membranes and facilitates expectoration; arnica (*Arnica montana*) relieves pain and accelerates the resorption of haematomas; St John's wort (*Hypericum perforatum*) has documented antidepressant action; elderberry (*Sambucus nigra*) is diaphoretic; and dandelion (*Taraxacum officinale*) supports bile secretion and digestion (Dobrowolski et al., 1955; Samochowiec et al., 2002; Schilcher & Dorsch, 2010).

Each of these plants has its own history. Aloe was known to the ancient Egyptians, and today its pulp is a basis of skin-regenerating preparations. Chamomile is perhaps the most universal herb in the world, used from gargling to easing digestive complaints. Nettle, treated for centuries as a weed, proved to be a treasure house of minerals, vitamins and chlorophyll. Sage owes its Latin name to *salvare*, to save, and for centuries served as an antiseptic of the oral cavity. Plantain is among the most effective expectorant herbs. Arnica, today under strict protection, was indispensable in contusions and haematomas. St John's wort has acquired the status of an antidepressant of proven action, and dandelion, an ordinary weed, supports the liver and digestion (Dobrowolski et al., 1955; Mikołajczak, 2018; Samochowiec et al., 2002; Schilcher & Dorsch, 2010). In

practice, herbs of similar action can substitute for or complement one another in mixtures, which facilitates composing

medicinal teas when one raw material is lacking (Table IV).

Table IV. Herbs of similar therapeutic action

Therapeutic action	Example herbs
Anti-inflammatory and disinfectant	chamomile, sage, thyme, oak bark, arnica
Expectorant	thyme, ribwort plantain, primrose, coltsfoot
Spasmolytic	chamomile, lemon balm, dill, caraway
Calming	lemon balm, valerian, hops, lavender
Diuretic	nettle, horsetail, goldenrod, birch leaf
Choleretic and cholagogue	dandelion, milk thistle, artichoke
Strengthening and immunostimulating	nettle, purple coneflower, ginseng, aloe

Source: compiled from (Dobrowolski et al., 1955; Samochowiec et al., 2002).

At home, phytotherapy also has a long and respectable tradition. Medicinal tinctures, alcoholic extracts of herbs, fruits and roots, formed the basis of household medicine cabinets for generations (Fiedoruk, 2009). Equally popular are home recipes for everyday ailments: onion syrup for cough, linden infusion for colds, plantain compresses for insect bites, and sage baths for excessive sweating of the feet. Such oral knowledge, however, is easily distorted, hence the growing importance of reliable publications and pharmaceutical advice (Lamer-Zarawska et al., 2012; Matławska, 2020).

3.4. Return to nature in cosmetology

Cosmetology is clearly turning back to natural raw materials. Plant extracts, vegetable oils, essential oils and herbal masks are returning to skin and hair care (Czerpak & Jabłońska-Trypuć, 2008; Fink, 2007), and the growing number of cosmetics based on natural ingredients goes hand in hand with a fashion for preparing simple products at

home (face masks, tonics, rinses). Home-made cosmetics have one indisputable advantage: one knows exactly what they contain and need not fear synthetic additives, which can cause allergic reactions (Dylewska-Grzelakowska, 1999; Fink, 2007). Preparing one's own mask of chamomile or a tonic of sage also has an educational dimension: a person who does so begins to understand how plant ingredients work and finds it easier to choose ready-made products consciously. As our results show, this practice remains niche.

3.5. Herbal medicine in paediatrics

In children, phytotherapy requires particular prudence and dosage strictly adjusted to age (Schilcher & Dorsch, 2010). Properly conducted, it can be more favourable than synthetic drugs because it is milder and less often causes side effects, but it must remain under medical control. The basic principles are to use only herbs of confirmed paediatric safety (chamomile, fennel, dill, thyme, plantain), to dose appropriately, and to avoid

alcoholic tinctures and toxic raw materials (Schilcher & Dorsch, 2010).

3.6. Related research on mineral waters, balneotherapy and phytocompositions

A large part of the experimental and clinical literature on spa treatment in Ukraine, which is the closest to the questions asked here, comes from the Truskavets spa and was published in this journal. Several series examined drinking mineral waters. The sulfate-chloride sodium-magnesium waters “Myroslava” and “Khrystyna” were studied for their effects on the neuroendocrine-immune complex, metabolism and immunity in patients and in healthy female rats (Badiuk et al., 2021; Gozhenko et al., 2022; Hrytsak et al., 2021a; Hrytsak et al., 2022a; Hrytsak et al., 2022c; Popovych et al., 2021a; Popovych et al., 2022a). Drinking monotherapy with Naftussya water was compared with therapy supplemented with these waters, with the neuroendocrine-immune complex, metabolism and the electroencephalogram as outcomes (Hrytsak et al., 2021b; Hrytsak et al., 2022b). The role of organic carbon and nitrogen and of trace elements of mineral waters in their effects was examined in female rats (Popovych et al., 2021b; Popovych et al., 2021c), and the quantitative contributions of the inorganic and organic components of Hertsa drinking mineral water were assessed in the same model (Žukow et al., 2026b). Further reports concern the biological activity of natural iron-containing mineral waters used internally (Babov et al., 2020), the influence of natural

mineral water on the kidneys of rats under urolithiasis modelling (Kucherenko et al., 2020), the effects of a mineral water from a well in the Poltava region on the kidneys in experimental nephritis (Gushcha et al., 2019), structural and functional changes in the kidneys of rats with toxic nephropathy after a course of drinking the mineral water “DONAT Mg” (Pavliuk et al., 2022), and the influence of magnesium preparations on metabolism in modelled toxic nephropathy (Pavliuk & Badiuk, 2022). The role of macronutrients in the corrective effect of low-mineralized water in experimental metabolic syndrome (Gozhenko et al., 2020), the effect of drinking mineral waters on the physical performance of female rats (Žukow et al., 2026a) and hydrogen-enriched “Truskavetska” bottled water (Savytskyi et al., 2025; Žukow & Popovych, 2024) were also studied.

Other papers concentrated on individual responses to balneotherapy. They described the diversity of immune reactions to balneotherapy and their accompaniments, as well as the vegetative, endocrine and metabolic accompaniments and predictors of individual immune responses to adaptogenic balneotherapy (Mel’nyk et al., 2019; Struk et al., 2019; Struk et al., 2020a; Struk et al., 2020b). Patients of the Truskavets spa were also classified into quantitative-qualitative blood pressure clusters, and the hemodynamic, autonomic, endocrine, electroencephalographic, metabolic and immune accompaniments of these clusters were described (Kozyavkina et al., 2020a;

Kozyavkina et al., 2020b; Kozyavkina et al., 2021; Kozyavkina et al., 2022a; Kozyavkina et al., 2022b). The personification of the attributive effects of balneotherapy (Melnik et al., 2025) and the general non-specific effects of the balneofactors on parameters of neuroendocrine regulation (Popovych et al., 2022b) were analysed in the same setting.

Phytotherapy at the same spa was investigated in a similar way. The Ukrainian phytocomposition “Balm Truskavets” was studied for its influence on the neuro-endocrine-immune complex and biophotonics in humans with maladaptation (Fihura et al., 2023), for its modulating effects on post-stress changes in rats (Żukow et al., 2024) and for the similarity of its adaptogenic effects to those of bioactive Naftussya water (Popovych, 2023). Later papers reported the effects of the phytotea ATINE on neural, endocrine, immune, metabolic and biophysical variables and its immunomodulatory effect together with the adaptogenic factors of the Truskavets’ spa (Bombushkar et al., 2025b; Bombushkar et al., 2025c), and compared the nonspecificity of the adaptogenic effects of “Balm Truskavets” and the tea ATINE (Bombushkar et al., 2025a). A historical and contemporary overview of biologically active components of mineral, synthetic, phyto- and organic origin was published in the context of local hemostatic agents (Abramov et al., 2025).

Work on water and fluid balance provides the physiological background for drinking cures: physiological principles of optimal

water use (Gozhenko & Lebedeva, 2010), the evolution of scientific paradigms in understanding water balance (Gozhenko et al., 2025b), water, proteins and volume regulation (Gozhenko et al., 2025a), the integrated regulation of water-sodium homeostasis (Gozhenko et al., 2025d) and the renal threshold for glucose in relation to water metabolism (Gozhenko et al., 2026). Regenerative rehabilitation and stress-induced metabolic disorders were discussed in two reviews (Badyin et al., 2025; Gozhenko et al., 2025c). Complementary methods were applied in the prevention and treatment of stress-induced mastopathy and in the rehabilitation of patients with post-traumatic stress disorder (Chukhraev et al., 2022; Chukhraev et al., 2023), and rehabilitation was addressed in a polyfactorial approach to the muscles of football players after sports injuries (Vladymyrov et al., 2022) and in the use of therapeutic exercises and massage in muscular torticollis (Samosiuk et al., 2011). These studies measure physiological responses to mineral waters, herbal compositions and rehabilitation, whereas the present survey measures knowledge, use and opinions; the two kinds of evidence are complementary.

4. Material and methods

4.1. Research questions and hypotheses

The study grew out of a master's thesis (Woźniak, 2013) whose methodological part formulated one main and seven specific hypotheses. For this article they were

condensed into five research questions, five research hypotheses and five statistical hypotheses. Their statistical wording was added by the authors and is limited to what can be analysed from the group-level data that are available (see Section 4.4).

Research questions. RQ1: How much do spa patients, visitors and residents of Inowrocław know about herbs, where does this knowledge come from, and does it differ between the three groups? RQ2: How common is the use of phytotherapy in spa treatment and in self-treatment, and does it differ between the groups? RQ3: How often have physicians proposed herbal treatment to respondents, and do the groups differ in this respect? RQ4: How strong is the demand for better promotion of herbal medicine and for extending herbal treatment in spas, and do the groups differ? RQ5: Do the groups differ in the use and home preparation of natural cosmetics and in access to herbal shops?

Research hypotheses. RH1: Knowledge of herbs comes mainly from the family and is poorest among the residents of the town, who are mostly younger. RH2: Phytotherapy is rarely used in spa treatment, but it is common in self-treatment. RH3: Physicians rarely propose herbal treatment; most respondents have never been offered it. RH4: Most respondents want herbal medicine to be promoted more and used more widely in spas, and hardly anyone opposes this. RH5: Preparing cosmetics at home is uncommon, particularly among spa patients, whereas

most respondents use natural cosmetics at least sometimes.

Statistical hypotheses (two-sided, significance level 0.05; π denotes a population proportion). SH1: H_0 , the proportion of respondents who do not know herbs and the distribution of knowledge sources (mother, grandmother, none) are the same in the three groups, and the proportion naming a family member as the source is 0.5; H_1 , at least one of these statements is false. SH2: H_0 , the proportion who used herbs in a spa is the same in the three groups and equals 0.5, and the proportion who take herbs on their own (spa patients and visitors) is the same in the two groups and equals 0.5; H_1 , at least one of these statements is false. SH3: H_0 , the proportion of respondents to whom a physician has never proposed herbal treatment is the same in the three groups and equals 0.5; H_1 , it differs between groups or from 0.5. SH4: H_0 , the proportions in favour of more promotion and in favour of extension in spas are each the same in the three groups and each equal 0.5; H_1 , at least one of them differs between groups or from 0.5. SH5: H_0 , the proportion who have ever prepared a cosmetic at home, and the proportion who use natural cosmetics at least sometimes, are each the same in the three groups and each equal 0.5; H_1 , at least one of them differs between groups or from 0.5. The value 0.5 is used only as a conventional reference that separates a majority from a minority.

4.2. Study design and instrument

The study used the diagnostic survey method with a questionnaire technique and an original questionnaire as the research tool (Pilch & Bauman, 2001; Łobocki, 2001). The questionnaire technique is a way of gathering information in which the respondent, usually independently, fills in a highly standardised form (Pilch & Bauman, 2001). The questionnaire consisted of closed-ended questions of single or multiple choice. The main dependent variable was the degree of use of phytotherapy in spa treatment and in self-treatment. Specific dependent variables were: the level of knowledge about the use and effectiveness of phytotherapy; demand for phytotherapy in spa treatment; the use of natural cosmetics; ease of obtaining knowledge about herbs; sources of this knowledge; taking herbs on one's own; opinions on promoting herbal medicine; and physicians' proposals of herbal treatment. The independent variables were age, sex, education and membership of one of the three groups (spa patients, visitors, residents) (Pilch & Bauman, 2001; Łobocki, 2001).

4.3. Participants and setting

The study group consisted of 58 persons of both sexes and various ages and economic status (pupils, students, white-collar and blue-collar workers, pensioners and unemployed people): spa patients, visitors and residents of Inowrocław. The survey was fully anonymous. Simple random sampling was applied: persons walking in the vicinity of the brine graduation towers in Inowrocław were

approached directly and asked to complete the questionnaire. About 60 people were approached, and 58 questionnaires were analysed. The Inowrocław graduation towers, located in the more than 100-year-old Brine Park, consist of two connected polygons, are 9 m high and 300 m long, and are the second largest in Poland; in the whole of Europe there are only nine such structures (Uzdrowisko Inowrocław, n.d.).

4.4. Data collection and reconstruction of counts

Data were collected on 19 May 2013. No significant difficulties were encountered: respondents willingly answered the questions. The individual questionnaires were not available for this report, so the analysis is based exclusively on the group-level results printed on the 17 charts of the thesis (Woźniak, 2013). Because the sizes of the three groups are known (28, 18 and 12), the printed percentages could be converted back into whole-person counts (for example, $22/28 = 78.6\%$, printed as 78.5%; $5/18 = 27.8\%$, printed as 27.7%). Every reconstructed count reproduced the printed percentage to within the truncation used in the source. Four inconsistencies in the source were handled as follows. First, the share of residents who favoured more promotion of herbal medicine is printed as 2.5%, which is incompatible with the 41.6% of 'no opinion' answers and with the text of the thesis; 7/12 (58.3%) was used. Second, the residents' answer 'no' on self-treatment with herbs is printed as 41.6%, so that the three answers add up to 116%; this

item was excluded from the tests for residents. Third, the share of spa patients who did not know herbs is printed as 42.8% in one chart and as 14.2% in another; the latter, which agrees with the text of the thesis, was used. Fourth, for spa patients the answers to some questions add up to 27 instead of 28, which was treated as one missing answer, and the tests were run on the available answers. One chart (use of phytotherapy, thesis Figure 6) contains values between 1.8% and 4.4% that cannot be interpreted and was not used.

4.5. Statistical methodology

Variables and data. All variables are categorical: group (three levels), sex, education, and answers with two to four options. Age was recorded in six bands and is therefore ordinal. Because only group-level results were available (Section 4.4), every analysis compares the three groups on one variable at a time; no analysis uses information on how the answers of the same person combine.

Descriptive statistics. Counts and percentages are given for each answer; percentages in Tables V to VII refer to the whole group, whereas tests and confidence intervals use the respondents who actually answered. Proportions are accompanied by exact (Clopper-Pearson) 95% confidence intervals. For age, only the median band and the first and third quartile bands are reported, since means and standard deviations cannot be obtained from bands.

Tests between groups. Differences among the three groups were tested with the Freeman-Halton extension of Fisher's exact test (two-sided; exact p values by full enumeration of all tables with the observed margins), because the expected counts were below 5 in most tables and the chi-square approximation is unreliable. The chi-square statistic with its degrees of freedom is shown only as a descriptive quantity, and Cramér's V is the effect size (about 0.1 small, 0.3 medium and 0.5 large for tables with two columns). Two groups were compared with Fisher's exact test; the effect size is the conditional maximum-likelihood odds ratio with an exact 95% confidence interval. Adjusted standardized residuals were calculated for the tables that were significant, to show which cells depart from independence; values beyond ± 1.96 are used descriptively.

Tests of a single proportion. For each pooled proportion, an exact two-sided binomial test against 0.5 was carried out; it asks whether the answer is held by a majority or a minority of respondents.

Multiplicity. Three families of tests were defined. Family A consists of the 14 between-group comparisons in Table VIII. Family B consists of the 12 pooled binomial tests in Table X. Family C consists of the three pairwise comparisons made within each outcome in Table IX. The Holm step-down method was applied within each family, and the significance level of 0.05 refers to the adjusted p value. Because the study is small

and exploratory, a non-significant result is not evidence that groups are equal.

Multivariate description. The only multivariate technique that can be applied to group-level counts is correspondence analysis. The groups and 15 answer categories were arranged in a table with three rows, and the singular value decomposition of the matrix of standardized residuals gives coordinates of the groups and the categories in at most two dimensions. Because the same respondents contribute to several categories, the chi-square value of this stacked table is not a valid test, so correspondence analysis is used here only as a descriptive map and no p value is attached to it.

Methods not applied. Canonical correlation analysis, discriminant analysis, cluster analysis and factor analysis, as well as regression models, need data on individual respondents: the correlations between items, or the values of several variables for each person. These data were not available, and three group profiles cannot be clustered or factorised in a meaningful way. These methods were therefore not applied, and no results from them are reported. They are the natural next step if the original questionnaires or a new sample become available (Section 6.1).

Software and checks. Calculations were performed in Python 3.14.3 with SciPy 1.18.1 and NumPy 2.5.3. The exact p values of the 14 between-group tests were verified with an independent implementation (Monte Carlo

permutation test, 2,000,000 permutations, seed 12345); all values agreed within 0.001, and the chi-square statistics, Cramér's V, Holm adjustments and confidence intervals were reproduced in 152 comparisons without discrepancy. The use of an AI system as a computational tool is described in the Disclosure.

Notation. N is the number of respondents who answered a question, x the number giving a particular answer, π a population proportion, OR the conditional odds ratio, CI a confidence interval, V Cramér's V, and p the two-sided exact p value; 'Holm p' is the p value adjusted by the Holm method within its family of tests. Percentages are rounded to one decimal place and p values to three decimals, with values below 0.001 reported as $p < 0.001$.

5. Results

5.1. Characteristics of the sample

Among the 58 respondents there were 41 women (70.7%; 95% CI 57.3-81.9) and 17 men (29.3%; 95% CI 18.1-42.7). The largest group were spa patients ($n = 28$; 48.3%), followed by visitors ($n = 18$; 31.0%) and residents of Inowrocław ($n = 12$; 20.7%). Most respondents had secondary education ($n = 36$; 62.1%); 13 (22.4%) had higher education, 7 (12.1%) basic vocational and 2 (3.4%) primary education. The most numerous age bands were 30-39 years ($n = 14$; 24.1%) and 60 years and over ($n = 13$; 22.4%); the youngest group, 19 years or less, was the smallest ($n = 2$; 3.4%) (Table V, Figure 1). The median age band was 40-49

years (first quartile band 30-39, third quartile band 50-59); because age was recorded only

in bands, no means or standard deviations are given.

Table V. Structure of the study sample (N = 58)

Variable	Category	n	%
Age	up to 19 years	2	3.4
	20-29 years	8	13.8
	30-39 years	14	24.1
	40-49 years	12	20.7
	50-59 years	9	15.5
	60 years and over	13	22.4
Sex	female	41	70.7
	male	17	29.3
Education	primary	2	3.4
	basic vocational	7	12.1
	secondary	36	62.1
	higher	13	22.4
Group	spa patients	28	48.3
	visitors	18	31.0
	residents	12	20.7

Source: Authors' own study.

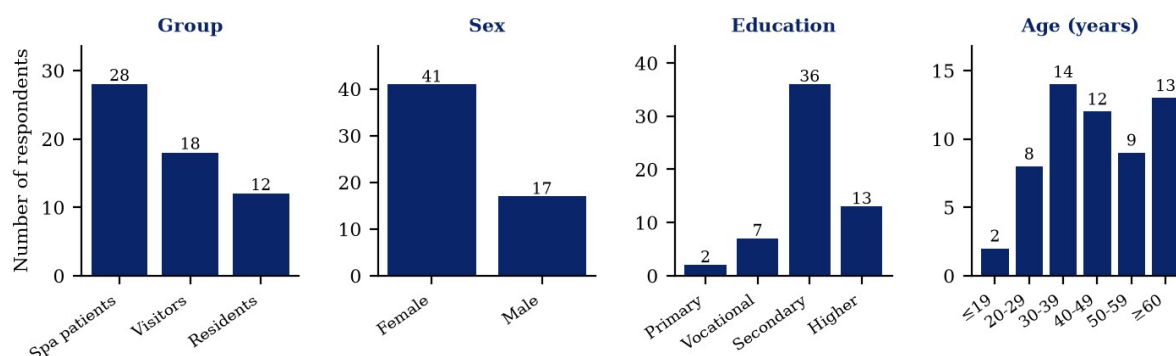


Figure 1. Structure of the study sample by group, sex, education and age (N = 58). Source: Authors' own study.

5.2. Knowledge about herbs and its sources

Knowledge about herbs was modest and differed between the groups. Among spa patients, 11 named their mother and 12 their grandmother as the source of their knowledge, and 4 did not know herbs (27 answers); among visitors the numbers were 10, 3 and 5, and among residents 2, 2 and 8

(Table VI). Altogether, 40 of 57 respondents (70.2%) pointed to their mother or grandmother. The share of respondents who did not know herbs was highest among residents (8/12, 66.7%, against 5/18, 27.8%, in visitors and 4/27, 14.8%, in spa patients; Freeman-Halton exact $p = 0.006$, $V = 0.43$). Pairwise, residents differed from spa patients

(OR 0.09; Holm-adjusted $p = 0.007$), but not significantly from visitors (adjusted $p = 0.12$). After correction for all 14 comparisons the overall difference was no longer significant (adjusted $p = 0.078$), so it should be regarded as suggestive only. The thesis describes residents as the youngest group, but age by group is not reported, and a relationship between knowledge and age could therefore not be tested.

5.3. Use of phytotherapy in spas and at home

Few respondents had used phytotherapy in a spa: 4 spa patients, 2 visitors and 2 residents answered yes, and another 1 spa patient and 4 visitors said sometimes. In total, 13 of 57 respondents (22.8%; 95% CI 12.7-35.8) had used herbs in a spa at least once, and the groups did not differ significantly (exact $p =$

0.50). Home use was much more frequent: 15 spa patients (53.6%), 12 visitors (66.7%) and 5 residents (41.7%) took herbs on their own, and a further 7 (25.0%), 1 (5.6%) and 4 (33.3%), respectively, did so sometimes (Table VI, Figure 2). Among spa patients and visitors, 35 of 46 (76.1%) used herbs on their own at least sometimes, with no difference between the two groups (22/28 vs 13/18; $p = 0.73$). Natural cosmetics were used at least sometimes by 16 of 28 spa patients, 15 of 18 visitors and 7 of 12 residents ($p = 0.16$). Preparing cosmetics at home, however, differed markedly: only 1 of 28 spa patients (3.6%) had ever done so, against 9 of 18 visitors (50.0%) and 3 of 12 residents (25.0%) (exact $p < 0.001$, adjusted $p = 0.009$; spa patients vs visitors, OR 0.04, adjusted $p = 0.001$).

Table VI. Use of herbs, knowledge and attitudes to natural products, by group of respondents: n (% of group)

Question / answer	Spa patients (n = 28)	Visitors (n = 18)	Residents (n = 12)
Used phytotherapy in a spa: yes	4 (14.3)	2 (11.1)	2 (16.7)
Used phytotherapy in a spa: sometimes	1 (3.6)	4 (22.2)	0 (0.0)
Used phytotherapy in a spa: no	22 (78.6)	12 (66.7)	10 (83.3)
Takes herbs on their own: yes	15 (53.6)	12 (66.7)	5 (41.7)
Takes herbs on their own: sometimes	7 (25.0)	1 (5.6)	4 (33.3)
Takes herbs on their own: no	6 (21.4)	5 (27.8)	not reported consistently*
Source of knowledge: mother	11 (39.3)	10 (55.6)	2 (16.7)
Source of knowledge: grandmother	12 (42.9)	3 (16.7)	2 (16.7)
Does not know herbs	4 (14.3)	5 (27.8)	8 (66.7)
Uses natural cosmetics: yes / sometimes / no	4 / 12 / 12	5 / 10 / 3	2 / 5 / 5
Prepares cosmetics at home: never / once / often	27 / 0 / 1	9 / 6 / 3	9 / 2 / 1
Prefers herbs to synthetic drugs: yes	8 (28.6)	8 (44.4)	3 (25.0)
Would gladly try herbal treatment	19 (67.9)	10 (55.6)	7 (58.3)
Prefers synthetic drugs / negative answer	0 (0.0)	0 (0.0)	2 (16.7)

Source: Authors' own calculations from the thesis charts. Percentages refer to the whole group; for spa patients some answers add up to 27 (one missing answer). *The chart printed 41.6%, which makes the answers add up to 116%.

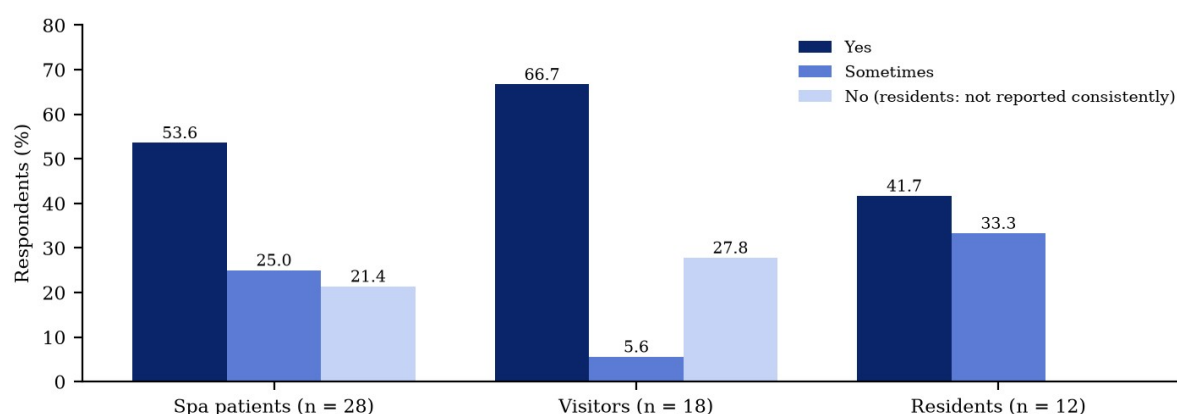


Figure 2. Taking herbs on one's own, by group of respondents (% of group). The residents' answer 'no' is omitted because the source reports it inconsistently. Source: Authors' own calculations from the thesis charts.

5.4. Attitudes towards promotion and development of phytotherapy

Asked whether herbal medicine should be promoted more, 24 spa patients (85.7%), 15 visitors (83.3%) and 7 residents (58.3%) answered yes, the others had no opinion (5 of 12 residents), and nobody said no (0 of 57; upper 95% confidence limit 6.3%). In total, 46 of 57 respondents (80.7%; 95% CI 68.1-90.0) were in favour, and the groups did not differ significantly after correction (exact $p = 0.099$).

Extension of herbal treatment in spas was supported by 23 spa patients (82.1%), 16 visitors (88.9%) and 7 residents (58.3%), that is by 46 of 57 respondents (80.7%) overall (exact $p = 0.11$), and again nobody objected (Table VII, Figure 3). Herbal shops near home were reported by 14 spa patients (50.0%), 8 visitors (44.4%) and 4 residents (33.3%); more shops were wanted by 15 (53.6%), 12 (66.7%) and 6 (50.0%), respectively, with no opposing answers (both differences not significant, $p = 0.65$).

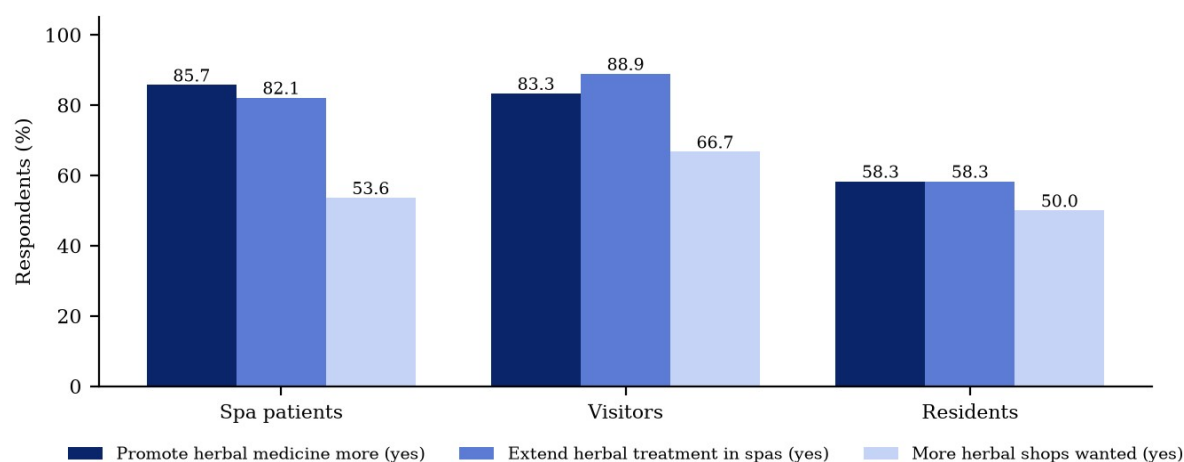


Figure 3. Positive answers on the promotion of herbal medicine, extension of herbal treatment in spas and the number of herbal shops, by group (% of group). No respondent answered no to any of these questions. Source: Authors' own calculations from the thesis charts.

5.5. Physicians and herbal treatment

Perhaps the most telling result concerns physicians. Herbal treatment had never been proposed by a doctor to 22 of 28 spa patients (78.6%), 12 of 18 visitors (66.7%) and 6 of 12 residents (50.0%), that is to 40 of 58 respondents (69.0%; 95% CI 55.5-80.5). A clear proposal (answer yes) was reported by 3, 2 and 2 respondents, respectively, and a single proposal (once) by 3, 4 and 4 (Table VII, Figure 4). The differences between the groups were not significant (exact $p = 0.21$ for ever vs never; $p = 0.40$ for the three answers), so

although residents reported 'never' least often, the data do not allow the conclusion that the groups differ. Altogether only 7 of 58 respondents (12.1%; 95% CI 5.0-23.3) had received a clear proposal. As regards synthetic drugs, 19 of 57 respondents (33.3%) said that they prefer herbs to pharmaceutical products and a further 36 (63.2%) would gladly try herbal treatment; a negative answer was given only by 2 residents (16.7% of residents; exact $p = 0.041$, adjusted $p = 0.46$).

Table VII. Attitudes of respondents towards phytotherapy, by group: n (% of group)

Question / answer	Spa patients (n = 28)	Visitors (n = 18)	Residents (n = 12)
Herbal medicine should be promoted more: yes	24 (85.7)	15 (83.3)	7 (58.3)*
Herbal medicine should be promoted more: no	0	0	0
In favour of extending herbal treatment in spas: yes	23 (82.1)	16 (88.9)	7 (58.3)
In favour of extending herbal treatment in spas: no	0	0	0
Herbal shop near home: yes	14 (50.0)	8 (44.4)	4 (33.3)
More herbal shops wanted: yes	15 (53.6)	12 (66.7)	6 (50.0)
Physician proposed herbal treatment: yes	3 (10.7)	2 (11.1)	2 (16.7)
Physician proposed herbal treatment: once	3 (10.7)	4 (22.2)	4 (33.3)
Physician proposed herbal treatment: never	22 (78.6)	12 (66.7)	6 (50.0)

Source: Authors' own calculations from the thesis charts. For spa patients some answers add up to 27. *Printed as 2.5% in the source chart; 7/12 follows from the 41.6% of no-opinion answers.

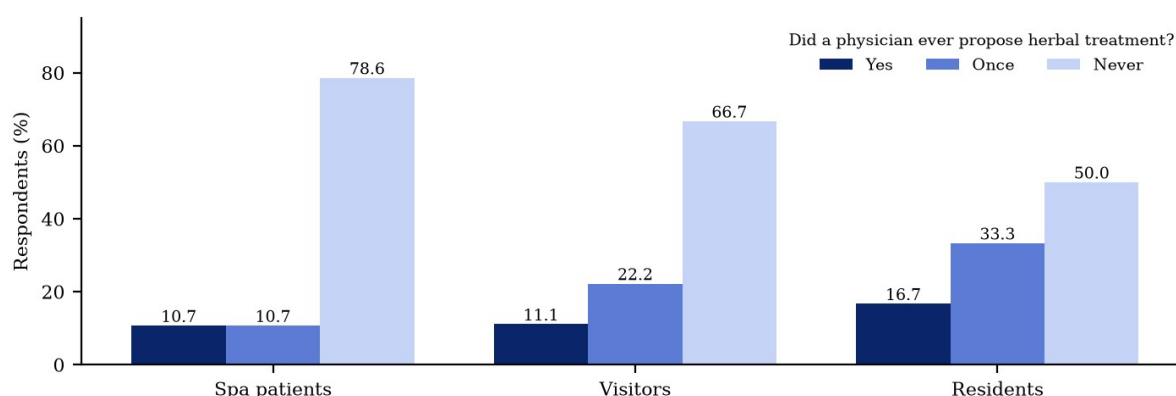


Figure 4. Physicians' proposals of herbal treatment, by group of respondents (% of group). Source: Authors' own calculations from the thesis charts.

5.6. Differences between the groups

Table VIII collects the 14 between-group comparisons. After Holm correction only one remained significant: home preparation of cosmetics (exact $p < 0.001$, adjusted $p = 0.009$, $V = 0.48$, a large effect). Adjusted standardized residuals show where the difference lies: spa patients prepared cosmetics less often than expected (-3.32) and visitors more often (+3.38). The difference in not knowing herbs (exact $p = 0.006$, $V = 0.43$) did not survive correction (adjusted $p = 0.078$); its residuals

point to residents (+3.14) and, in the opposite direction, to spa patients (-2.35). The distribution of knowledge sources (exact $p = 0.012$) and the negative answer to the question on preferring herbs to drugs (exact $p = 0.041$, given by 2 of 12 residents and nobody else; expected counts well below 1) also lost significance after correction. For all other variables the groups did not differ significantly, but with groups of 12 to 28 persons such tests have little power.

Table VIII. Comparisons between the groups (exact tests; Holm correction over 14 comparisons)

Variable	Counts: spa / visitors / residents	Chi-square (df)	Exact p	Holm p	V
Does not know herbs	4/27, 5/18, 8/12	10.72 (2)	0.006	0.078	0.43
Source: mother / grandmother / none	3 x 3 table	13.90 (4)	0.012	0.143	0.35
Used herbs in a spa (yes or sometimes)	5/27, 6/18, 2/12	1.67 (2)	0.502	1.000	0.17
Takes herbs on own (yes or sometimes); spa vs visitors	22/28, 13/18	0.24 (1)	0.728	1.000	0.07
Takes herbs on own: yes / sometimes / no; spa vs visitors	2 x 3 table	2.89 (2)	0.265	1.000	0.25
Uses natural cosmetics (yes or sometimes)	16/28, 15/18, 7/12	3.67 (2)	0.160	1.000	0.25
Has ever prepared cosmetics at home	1/28, 9/18, 3/12	13.64 (2)	<0.001	0.009	0.48
Prefers herbs to drugs: negative answer	0/27, 0/18, 2/12	7.77 (2)	0.041	0.455	0.37
Promote herbal medicine more: yes	24/27, 15/18, 7/12	5.10 (2)	0.099	0.994	0.30
Extend herbal treatment in spas: yes	23/27, 16/18, 7/12	4.98 (2)	0.111	0.999	0.30
Herbal shop near home: yes	14/28, 8/18, 4/12	0.94 (2)	0.653	1.000	0.13
More herbal shops wanted: yes	15/28, 12/18, 6/12	1.06 (2)	0.649	1.000	0.14
Physician proposed herbs (yes or once)	6/28, 6/18, 6/12	3.27 (2)	0.207	1.000	0.24
Physician: yes / once / never	3 x 3 table	3.69 (4)	0.399	1.000	0.18

Source: Authors' own calculations from the thesis charts. Exact p: Freeman-Halton (three groups) or Fisher (two groups). V: Cramér's V (descriptive; expected counts below 5 in most tables).

5.7. Pairwise comparisons

Table IX gives the pairwise comparisons for the main outcomes. Two differences remained significant after Holm adjustment within the outcome: not knowing herbs, spa patients against residents (OR 0.09; 95% CI 0.01-0.54; adjusted $p = 0.007$), and home

preparation of cosmetics, spa patients against visitors (OR 0.04; 95% CI 0.00-0.35; adjusted $p = 0.001$). The wide intervals reflect the small groups. In the remaining comparisons the confidence intervals include 1; some of them are very wide, so the data are compatible with both no difference and a large one.

Table IX. Pairwise comparisons: conditional odds ratio (exact 95% CI) and Holm-adjusted Fisher p

Outcome	Spa patients vs visitors	Spa patients vs residents	Visitors vs residents
Does not know herbs	OR 0.46 (0.08-2.56) Holm p = 0.449	OR 0.09 (0.01-0.54) Holm p = 0.007	OR 0.20 (0.03-1.18) Holm p = 0.122
Used herbs in a spa	OR 0.46 (0.09-2.25) Holm p = 0.912	OR 1.13 (0.15-13.83) Holm p = 1.000	OR 2.43 (0.33-29.83) Holm p = 0.912
Uses natural cosmetics	OR 0.27 (0.04-1.30) Holm p = 0.320	OR 0.95 (0.19-4.55) Holm p = 1.000	OR 3.41 (0.50-28.63) Holm p = 0.420
Has prepared cosmetics at home	OR 0.04 (0.00-0.35) Holm p = 0.001	OR 0.12 (0.00-1.69) Holm p = 0.146	OR 2.89 (0.49-22.24) Holm p = 0.260
Would gladly try herbs	OR 1.87 (0.46-7.84) Holm p = 1.000	OR 1.67 (0.32-8.55) Holm p = 1.000	OR 0.90 (0.16-4.90) Holm p = 1.000
Promotion of herbal medicine: yes	OR 1.58 (0.19-13.43) Holm p = 0.670	OR 5.41 (0.82-44.11) Holm p = 0.238	OR 3.41 (0.50-28.63) Holm p = 0.420
Extension in spas: yes	OR 0.72 (0.06-5.78) Holm p = 1.000	OR 3.94 (0.65-26.20) Holm p = 0.251	OR 5.36 (0.68-69.32) Holm p = 0.251
More herbal shops: yes	OR 0.58 (0.14-2.29) Holm p = 1.000	OR 1.15 (0.24-5.53) Holm p = 1.000	OR 1.95 (0.35-11.44) Holm p = 1.000
Herbal shop near home	OR 1.24 (0.33-4.86) Holm p = 1.000	OR 1.97 (0.41-11.09) Holm p = 1.000	OR 1.58 (0.28-9.95) Holm p = 1.000
Physician never proposed	OR 1.81 (0.39-8.52) Holm p = 0.916	OR 3.53 (0.68-19.62) Holm p = 0.389	OR 1.95 (0.35-11.44) Holm p = 0.916
Physician proposed (yes or once)	OR 0.55 (0.12-2.57) Holm p = 0.916	OR 0.28 (0.05-1.48) Holm p = 0.389	OR 0.51 (0.09-2.85) Holm p = 0.916

Source: Authors' own calculations from the thesis charts. The odds ratio refers to the first group named; the outcome is the answer given in the row label.

5.8. Pooled estimates and tests against 0.5

Table X shows the pooled proportions with exact 95% confidence intervals and the exact binomial test against 0.5 (Holm adjusted within the 12 tests). Majorities were demonstrated for wanting more promotion and for extension of herbal treatment in spas (46 of 57 respondents each), for having a family source of knowledge (40 of 57), for never having been offered herbs by a physician (40 of 58) and for taking herbs on

one's own among spa patients and visitors (35 of 46). Minorities were demonstrated for use of herbs in a spa (13 of 57), for having prepared cosmetics at home (13 of 58) and for a clear proposal by a physician (7 of 58). A majority using natural cosmetics at least sometimes (38 of 58) was suggested but did not remain significant after adjustment (adjusted p = 0.099), and the proportions who would gladly try herbal treatment, have an herbal shop near home or want more shops are compatible with 0.5.

Table X. Pooled proportions with exact 95% confidence intervals and exact binomial test against 0.5

Outcome	x/N	%	95% CI	Exact p	Holm p
Respondents who want herbal medicine promoted more	46/57	80.7	68.1-90.0	<0.001	<0.001
Respondents who favour extending herbal treatment in spas	46/57	80.7	68.1-90.0	<0.001	<0.001
Physician never proposed herbal treatment	40/58	69.0	55.5-80.5	0.005	0.027

Used herbs in a spa (yes or sometimes)	13/57	22.8	12.7-35.8	<0.001	<0.001
Takes herbs on their own, yes or sometimes (spa patients and visitors only)	35/46	76.1	61.2-87.4	<0.001	0.004
Named mother or grandmother as the source of knowledge	40/57	70.2	56.6-81.6	0.003	0.019
Would gladly try herbal treatment	36/57	63.2	49.3-75.6	0.063	0.188
Uses natural cosmetics (yes or sometimes)	38/58	65.5	51.9-77.5	0.025	0.099
Has ever prepared cosmetics at home	13/58	22.4	12.5-35.3	<0.001	<0.001
Herbal shop near home	26/58	44.8	31.7-58.5	0.512	0.716
More herbal shops wanted	33/58	56.9	43.2-69.8	0.358	0.716
Physician clearly proposed herbal treatment (yes)	7/58	12.1	5.0-23.3	<0.001	<0.001

Source: Authors' own calculations from the thesis charts. Holm adjustment within the 12 tests of this table.

5.9. Correspondence analysis

The correspondence analysis of the group-by-answer table (Figure 5) places all the information in two dimensions, because a table with three rows has at most two. The first dimension accounts for 60.6% and the second for 39.4% of the total inertia (0.117). On the first dimension residents (coordinate +0.43) are opposed to spa patients (-0.25). Residents lie close to not knowing herbs,

having no opinion on promotion and on extension in spas, and a single physician proposal; spa patients lie close to knowledge from the grandmother and to never having been offered herbs by a physician. The second dimension separates visitors (-0.30), who are associated with having prepared cosmetics at home and with having used herbs in a spa. This map is descriptive; it summarises the profiles shown in Tables VI and VII and does not test any hypothesis.

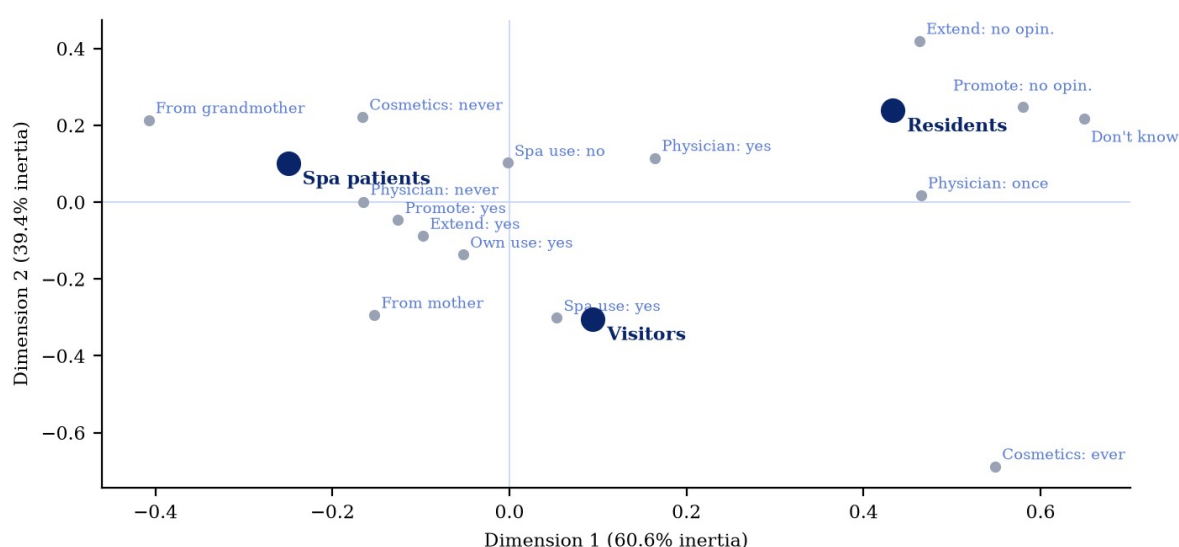


Figure 5. Correspondence analysis of the group-by-answer table (descriptive; the two dimensions carry the whole inertia). Source: Authors' own calculations from the thesis charts.

5.10. Verification of the hypotheses

Table XI relates the research and statistical hypotheses to the results. A hypothesis is

described as supported when the pooled data and, where relevant, the between-group tests agree with its wording after adjustment for multiplicity.

Table XI. Research hypotheses (RH) and statistical hypotheses (SH): decisions

Hypothesis	Statistical result	Decision
RH1 / SH1: knowledge from the family; residents know least	Family source 40/57 (70.2%), exact $p = 0.003$, Holm $p = 0.019$. Not knowing herbs: 4/27, 5/18, 8/12; exact $p = 0.006$, Holm $p = 0.078$, $V = 0.43$. Source distribution: exact $p = 0.012$, Holm $p = 0.143$	RH1 partly supported. SH1: family majority, H_0 rejected; equality across groups not rejected after Holm (suggestive)
RH2 / SH2: rare in spas, common at home	Spa use 13/57 (22.8%), exact $p < 0.001$, Holm $p < 0.001$; groups $p = 0.502$. Own use, spa patients and visitors, 35/46 (76.1%), Holm $p = 0.004$; groups $p = 0.728$	RH2 supported. SH2: H_0 rejected for both pooled proportions; equality not rejected
RH3 / SH3: physicians rarely propose	Never 40/58 (69.0%), exact $p = 0.005$, Holm $p = 0.027$; clear proposal 7/58 (12.1%), $p < 0.001$; groups $p = 0.207$	RH3 supported. SH3: H_0 rejected for the pooled proportion; equality across groups not rejected
RH4 / SH4: demand for promotion and extension	Promotion 46/57 (80.7%) and extension 46/57 (80.7%), both Holm $p < 0.001$; groups $p = 0.099$ and 0.111 ; no opposing answers (0/57)	RH4 supported. SH4: H_0 rejected for both pooled proportions; equality not rejected
RH5 / SH5: cosmetics	Home preparation 13/58 (22.4%), Holm $p < 0.001$; groups $p < 0.001$, Holm $p = 0.009$, $V = 0.48$. Natural cosmetics 38/58 (65.5%), Holm $p = 0.099$; groups $p = 0.160$	RH5 partly supported. SH5: H_0 rejected for home preparation (pooled and between groups); not rejected for natural cosmetics

Source: Authors' own calculations from the thesis charts. The thesis hypotheses on the effectiveness of herbs and on the availability of reliable literature could not be assessed from the available data.

6. Discussion

The strongest finding of the study is the unanimity of attitudes: none of the 57 to 58 respondents who answered opposed better promotion of herbal medicine, extension of herbal treatment in spas, or a larger number of herbal shops. In questionnaire studies such complete agreement is rare and suggests that phytotherapy enjoys genuine social support. At the same time, the results reveal a curious gap between what people expect and what Polish spas actually offer. Respondents clearly want phytotherapy: eight in ten want better promotion, and the same share favour extending it in spas. Yet fewer than one in

four (13 of 57) had ever experienced herbal treatment in a spa.

Particularly worrying is the contrast between the rarity of physicians' proposals of herbal treatment (a clear proposal was reported by only 7 of 58 respondents) and the prevalence of self-treatment (35 of 46 spa patients and visitors used herbs on their own at least sometimes). Self-treatment without consultation entails the risk of dosage errors, interactions with synthetic drugs and delayed diagnosis (Samochowiec et al., 2002; Schilcher & Dorsch, 2010). Herbal medicine in Poland functions largely in an informal circuit based on family transmission rather than on medical knowledge. Since this transmission

weakens from generation to generation, as suggested by the higher share of residents who did not know herbs, although this difference did not remain significant after correction for multiple comparisons, social competence in this area will keep declining without systematic education.

The example of the Sebastianum in Bad Wörishofen shows that phytotherapy can be sensibly integrated into a spa treatment programme as an element of hydrotherapy, inhalation therapy, diet and prevention, under medical supervision and with standardisation of procedures (Locher & Pforr, 2014; Ponikowska, 2012). Cohort observations indicate real benefit of a complex Kneipp cure for pain and quality of life (Leuchtgens et al., 1999), although systematic reviews rightly demand more rigorous evidence (Ehnert & Geiser, 2022; Reisecker et al., 2026; Stier-Jarmer et al., 2021). Rationality in this area has also been discussed in other countries, for example in Slovenia, where the role of phytotherapy in the country and worldwide was the subject of a separate analysis (Krsnik et al., 2022). Polish spas, including Inowrocław with its unique graduation towers (Uzdrowisko Inowrocław, n.d.), have the conditions to implement similar programmes, particularly for respiratory, dermatological and rheumatic diseases in which plant additives have documented applications (Tables II and III).

An interesting signal is the role of herbal retail. Herbal shops were present in the vicinity of homes of a considerable part of

respondents, and most respondents would like more of them. This indicates that the infrastructure for selling herbal raw materials exists and meets with social approval, while the link connecting it with medicine is missing: expert advice and promotion based on evidence rather than on fashion. It should also be admitted that respondents' enthusiasm for herbs does not always go hand in hand with knowledge. Declarations of willingness to try phytotherapy (56-68%) coupled with a poor stock of information about raw materials create ground for unreliable sellers and pseudo-scientific advice. Evidence-based education in schools, media and doctors' offices is therefore not only an opportunity but also a safeguard for patients.

The requirement of safe development of spa phytotherapy is compliance with the law, namely Directive 2004/24/EC and HMPC monographs (European Parliament & Council of the European Union, 2004), and health education, which should be part of every spa treatment programme (Ponikowska et al., 1995; Ponikowska, 2012). Phytotherapy does not compete with conventional medicine but complements it: in spa treatment, a herbal additive to a bath reinforces the action of mineral water, medicinal tea supports the diet, and a hay compress prepares the body for kinesitherapy.

6.1. Limitations

The study has clear limitations. The sample is small ($n = 58$), the measurement was made once, at one site and on one day, and

sampling was by approaching passers-by, which does not guarantee representativeness. Most importantly, the individual questionnaires were not available, so the analysis rests on group-level percentages from the thesis charts converted back into counts; four inconsistencies in the source were resolved as described in Section 4.3, and some counts for spa patients are based on 27 instead of 28 answers. Group sizes (12 to 28 persons) are small, expected counts were below 5 in most tables, and 14 comparisons were made, so power is low and the significance of single results is fragile; non-significant differences should not be read as evidence of equality. Multivariable analyses (regression, canonical correlation, discriminant, cluster and factor analysis) and analyses by age, sex and education, including the relationship between a physician's proposal and the use of herbs, were not possible, because they require data on individual respondents; correspondence analysis is only a descriptive map. Some questionnaire items were worded in a way that could suggest the expected answer (for example, items 6 and 26 in Appendix A), which may have inflated positive attitudes towards herbs. The data are from 2013, so attitudes may have changed. The results should therefore be regarded as exploratory. A natural next step would be a multi-centre survey in other Polish spas with a larger, stratified sample, individual-level data and multivariable analysis of the relationships between age, sex, education and the

knowledge and attitudes towards phytotherapy.

6.2. Practical implications

The results allow a realistic programme of action to be outlined. First, education: elements of knowledge on medicinal plants should be introduced into school health education and into the educational programmes run in spas, which by definition are places where proper habits are formed (Ponikowska et al., 1995; Ponikowska, 2012). Second, staff: physicians and pharmacists should receive reliable, evidence-based knowledge of phytotherapy during undergraduate and postgraduate training (Lamer-Zarawska et al., 2012; Matławska, 2020). Third, the offer: Polish spas could enrich their programmes with herbal additives to baths, inhalations and compresses, drawing on the experience of Kneipp clinics and respecting safety standards (Locher & Pforr, 2014; Ponikowska, 2012). Fourth, research: Polish analyses of the efficacy and cost-effectiveness of herbal therapy in spa conditions are needed, without which phytotherapy will remain on the margin of reimbursement and standards (Ehnert & Geiser, 2022; Reisecker et al., 2026; Stier-Jarmer et al., 2021).

7. Conclusions

1. Knowledge of herbs comes mainly from the family: 40 of 57 respondents (70.2%; 95% CI 56.6-81.6) named a mother or grandmother, a majority (exact binomial $p = 0.003$, Holm $p = 0.019$).

2. Residents know herbs least: 8 of 12 residents, 5 of 18 visitors and 4 of 27 spa patients said they did not know herbs (exact $p = 0.006$; $V = 0.43$). This is only suggestive, because the difference did not remain significant after correction for 14 comparisons (adjusted $p = 0.078$), although residents differed from spa patients in the pairwise comparison (OR 0.09; adjusted $p = 0.007$).

3. Phytotherapy is rarely used in Polish spas: 13 of 57 respondents (22.8%; 95% CI 12.7-35.8) had used it there, a minority (Holm $p < 0.001$), and the three groups did not differ (exact $p = 0.502$).

4. Home use of herbs is common: 35 of 46 spa patients and visitors (76.1%; 95% CI 61.2-87.4) took herbs on their own at least sometimes (Holm $p = 0.004$), with no difference between the two groups ($p = 0.728$).

5. Physicians rarely propose herbal treatment: it had never been proposed to 40 of 58 respondents (69.0%; 95% CI 55.5-80.5; Holm $p = 0.027$) and clearly proposed to only 7 (12.1%; 95% CI 5.0-23.3). The groups did not differ significantly (exact $p = 0.207$; $V = 0.24$), so the data do not show that one group is better served than another.

6. Demand for better promotion of herbal medicine is high: 46 of 57 respondents (80.7%; 95% CI 68.1-90.0; Holm $p < 0.001$) were in favour and nobody was against (0 of 57; the upper 95% limit for opposition is 6.3%). Residents were less often in favour

(58.3%), but the group difference was not significant (exact $p = 0.099$).

7. Demand for extending herbal treatment in spas is equally high: 46 of 57 respondents (80.7%; 95% CI 68.1-90.0; Holm $p < 0.001$), with no significant group difference (exact $p = 0.111$) and no opposing answers.

8. Preparing cosmetics at home is uncommon and differs between the groups: 1 of 28 spa patients, 9 of 18 visitors and 3 of 12 residents (exact $p < 0.001$; adjusted $p = 0.009$; $V = 0.48$, a large effect). It is the only between-group difference that remained significant after correction for multiplicity, whereas natural cosmetics themselves were used at least sometimes by 38 of 58 respondents (65.5%) without a significant majority after adjustment (Holm $p = 0.099$).

9. Access to herbal shops does not distinguish the groups: 26 of 58 respondents (44.8%) had a shop near home and 33 of 58 (56.9%) wanted more of them, both compatible with 0.5, and the groups did not differ (exact $p = 0.653$ and 0.649). The retail infrastructure exists, but the data do not show that it is a point of difference between spa patients, visitors and residents.

10. The profiles of the three groups differ mainly along one axis: in the correspondence analysis the first dimension carries 60.6% of the inertia and separates residents (not knowing herbs, no opinion on promotion and extension) from spa patients (family tradition, physician never proposed herbs), and the second (39.4%) separates visitors

(home-made cosmetics, use in spas). These are descriptive results and call for a larger multi-centre study with individual-level data, in which canonical, discriminant, cluster and factor analyses could be carried out and the effects of age, sex and education tested.

Disclosure

Author Contributions. Conceptualization (study design), O.W. and W.Ż.; investigation (data collection), O.W., K.B. and W.Ż.; formal analysis (statistical analysis), O.W., K.B. and W.Ż.; data interpretation, O.W., K.B. and W.Ż.; writing—original draft preparation, O.W. and W.Ż.; writing—review and editing, O.W., K.B. and W.Ż.; supervision, W.Ż. Codes shown after the author names on the title page: A, study design; B, data collection; C, statistical analysis; D, data interpretation. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement. Participation was voluntary and anonymous; respondents agreed to complete the questionnaire.

Data Availability Statement. The analysis is based on group-level results printed in the master's thesis of O.W. (Woźniak, 2013);

individual-level responses are not available. The reconstructed counts are given in Tables VI and VII and in Appendix B, and the calculation script (Python) is available on request from the corresponding author.

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Use of Artificial Intelligence. The statistical analysis in this article was carried out with the help of an artificial-intelligence system used as a computational tool (Perplexity Computer, an AI agent that writes and runs Python code). Its tasks were: (1) reading the percentages printed on the 17 charts of the thesis and converting them into whole-person counts; (2) writing and running Python scripts (Python 3.14.3, SciPy 1.18.1, NumPy 2.5.3) for descriptive statistics, exact binomial and contingency-table tests, odds ratios, confidence intervals, Holm correction and correspondence analysis; (3) preparing the tables and figures; and (4) searching the Crossref records of the cited authors for related publications, checking each added reference (authors, title, journal, volume, pages and DOI) against Crossref, and formatting the reference list in APA 7; and (5) translation, language editing and layout of the manuscript. Justification for using AI in the calculations: the groups are small and the

tables sparse, so exact $r \times c$ tests were required that are not offered by standard menu-driven software; more than seventy tests, intervals and effect sizes had to be calculated with consistent multiplicity control, which is error-prone by hand; and a script makes every number reproducible and easy to re-run. The AI did not collect data, did not supply any value that is not derived from the thesis charts, and is not an author. To limit the risk of error, the reconstructed counts were checked against the printed percentages, the exact p values, chi-square statistics, Cramér's V , Holm adjustments and confidence intervals were re-computed with an independent implementation (Monte Carlo permutation test with 2,000,000 permutations; 152 comparisons, no discrepancy), and the authors reviewed the results against the thesis. The authors take full responsibility for the content of the article.

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Appendix A. Survey questionnaire (English translation of the original Polish instrument)

Introductory note to respondents: the author is a student of the Wyższa Szkoła Gospodarki in Bydgoszcz (Tourism and Recreation, Spa Tourism and SPA) writing a thesis on phytotherapy in spa treatment; all information will be used for scientific purposes only; the questionnaire is anonymous. Respondent's details: sex; age (19 or less, 20-29, 30-39, 40-49, 50-59, 60 and over); education; place of residence; group (spa patient, visitor, resident).

No.	Question	Answer options
1	Do you use, or have you used, phytotherapy?	yes / no / maybe once
2	Where did you get your current knowledge about herbs?	mother / grandmother / I know nothing about herbs
3	Where do you look for knowledge about phytotherapy?	the Internet / books / family members / a physician
4	Do you know that combined therapy (taking drugs together with herbs, under strict medical supervision) is more effective?	yes, I know / yes, I know and use it / no, I had no idea
5	Do you think herbal medicine should be promoted more?	yes / no / no opinion
6	Do you know that herbs do not cause adverse effects like pharmaceutical drugs?	yes / no / nobody ever mentioned it
7	Herbs are used in spas to treat disorders. Are you in favour of extending this method of treatment in Poland?	yes / no / I don't know
8	Do you use, or have you used, phytotherapy in a spa?	yes / no / sometimes
9	Do you think herbs are an effective method of treatment?	yes / no / I don't know
10	Would you like to use herbs instead of pharmaceutical products?	yes / I will gladly try / no
11	Do you think natural cosmetics are better?	yes / no / I don't know / makes no difference
12	Do you use natural cosmetics?	yes / no / sometimes
13	Do you pay attention to whether a cosmetic is natural?	yes / no / makes no difference
14	When buying so-called natural cosmetics, do you check the natural ingredients on the label?	yes / no / rarely
15	Natural cosmetics are heavily promoted in the media. Is your purchase decision dictated by advertising?	yes / no / I don't think so
16	Is it worth spending a little more on cosmetics based on natural ingredients?	yes / rather yes / I don't spend much on cosmetics
17	Do you ever prepare a cosmetic at home for your own use?	never / maybe once / often
18	Is it easy to find out how to prepare a cosmetic yourself?	yes / no / I haven't checked
19	Are there herbal shops near your home?	yes / no / I don't know
20	Would you like there to be more such shops?	yes / no / no opinion
21	Many cosmetics containing parabens cause allergic reactions.	I avoid such cosmetics / it doesn't bother me / it is not important

22	Do you know that phytotherapy is used in spas in other European countries?	yes / no / I am not interested
23	Do you take any herbs on your own?	yes / no / sometimes
24	Has a physician ever proposed herbal therapy to you?	yes / no / maybe once
25	Do you think such therapy is effective?	yes / no / no opinion
26	Do you know that phytotherapy in Polish spa treatment has been abolished, while it is developing vigorously in other European countries?	yes, but I do not believe in the effectiveness of herbs / yes, it is a great loss for spa patients / I did not know it had ever existed
27	Would you like phytotherapy to be restored in spa treatment?	yes / no / no opinion

Appendix B. Reconstructed counts, percentages and exact 95% confidence intervals for the main outcomes

Each cell shows x/N (the respondents giving the answer among those who answered) and, below it, the percentage with its exact Clopper-Pearson 95% confidence interval in brackets. Counts were reconstructed from the group-level percentages printed on the charts of the thesis (Section 4.4).

Outcome	Spa patients	Visitors	Residents	All respondents
Does not know herbs	4/27 14.8 (4.2-33.7)	5/18 27.8 (9.7-53.5)	8/12 66.7 (34.9-90.1)	17/57 29.8 (18.4-43.4)
Named mother or grandmother as source	23/27 85.2 (66.3-95.8)	13/18 72.2 (46.5-90.3)	4/12 33.3 (9.9-65.1)	40/57 70.2 (56.6-81.6)
Used herbs in a spa (yes or sometimes)	5/27 18.5 (6.3-38.1)	6/18 33.3 (13.3-59.0)	2/12 16.7 (2.1-48.4)	13/57 22.8 (12.7-35.8)
Takes herbs on their own (yes or sometimes)*	22/28 78.6 (59.0-91.7)	13/18 72.2 (46.5-90.3)	9/12 75.0 (42.8-94.5)	44/58 75.9 (62.8-86.1)
Uses natural cosmetics (yes or sometimes)	16/28 57.1 (37.2-75.5)	15/18 83.3 (58.6-96.4)	7/12 58.3 (27.7-84.8)	38/58 65.5 (51.9-77.5)
Has prepared cosmetics at home	1/28 3.6 (0.1-18.3)	9/18 50.0 (26.0-74.0)	3/12 25.0 (5.5-57.2)	13/58 22.4 (12.5-35.3)
Prefers herbs to synthetic drugs	8/27 29.6 (13.8-50.2)	8/18 44.4 (21.5-69.2)	3/12 25.0 (5.5-57.2)	19/57 33.3 (21.4-47.1)
Would gladly try herbal treatment	19/27 70.4 (49.8-86.2)	10/18 55.6 (30.8-78.5)	7/12 58.3 (27.7-84.8)	36/57 63.2 (49.3-75.6)
Herbal medicine should be promoted more: yes	24/27 88.9 (70.8-97.6)	15/18 83.3 (58.6-96.4)	7/12 58.3 (27.7-84.8)	46/57 80.7 (68.1-90.0)
In favour of extending herbal treatment in spas	23/27 85.2 (66.3-95.8)	16/18 88.9 (65.3-98.6)	7/12 58.3 (27.7-84.8)	46/57 80.7 (68.1-90.0)
More herbal shops wanted	15/28 53.6 (33.9-72.5)	12/18 66.7 (41.0-86.7)	6/12 50.0 (21.1-78.9)	33/58 56.9 (43.2-69.8)
Herbal shop near home	14/28 50.0 (30.6-69.4)	8/18 44.4 (21.5-69.2)	4/12 33.3 (9.9-65.1)	26/58 44.8 (31.7-58.5)
Physician never proposed herbal treatment	22/28 78.6 (59.0-91.7)	12/18 66.7 (41.0-86.7)	6/12 50.0 (21.1-78.9)	40/58 69.0 (55.5-80.5)
Physician proposed herbal treatment:	3/28	2/18	2/12	7/58

yes	10.7 (2.3-28.2)	11.1 (1.4-34.7)	16.7 (2.1-48.4)	12.1 (5.0-23.3)
Physician proposed herbal treatment (yes or once)	6/28 21.4 (8.3-41.0)	6/18 33.3 (13.3-59.0)	6/12 50.0 (21.1-78.9)	18/58 31.0 (19.5-44.5)

Source: Authors' own calculations from the thesis charts. *Residents are excluded from the tests of this item (see Table VI).