Chapter 11
Complexity of Knowledge in Primary Care: Understanding the Discipline's Requisite Knowledge—A Bibliometric Study

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11.1 Starting the Quest to Understand the Requisite Knowledge for Family Medicine

When I did my family medicine internship over 10 years ago, my tutor was reviewing the German version of Zollo's book *Fragen und Antworten zur Allgemein-medizin. "Medical Secrets"* (Questions and Answers about General Practice/Family Medicine. "Medical Secrets") [1] for some academic teaching journal [2]. So we talked about exam questions and medical knowledge, and skimming through Zollo's book, I found this table that aroused my interest (Table 11.1, first two columns from Zollo, 685p).

This table showed the ranking of *reasons for encounter* from the patient's point of view compared to that of their treating physicians. The book is nothing more than a catalogue of "need-to-know" questions and answers claiming—ironically—to entail the discipline's "Medical Secrets". Zollo's book title intimates that it conveys all of the essential knowledge required by a general practitioner/family physician (GP/FM). He implies that his book embraces the patient's perception of his illness and that it provides the clinician with the requisite skills to manage the patient's illnesses from his perspective.

However, the book's order and emphasis do not embrace the epidemiology of *reason for encounter* of either the patient or the clinician; rather it follows the

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Table 11.1 *Reasons for encounter*—The malalignment between patients', clinicians' and educators' perceptions

Reasons for encounter—the patient's view	Reasons for encounter—the clinician's view	Content of Zollo's book
1. General medical examination	1. Essential hypertension	1. Overview of internal medicine's conditions
2. Hypertension	2. Diabetes mellitus	2. Endocrinology
3. Progress visit, no other symptoms	3. Chronic ischemic heart disease	3. Cardiology
4. Chest pain and related symptoms	4. Acute upper respiratory infection	4. Infectious diseases
5. Cough	5. General medical examination	5. Gastroenterology
6. Blood pressure test	6. Osteoarthritis and allied diseases	6. Oncology
7. Diabetes mellitus	7. General symptoms	7. Nephrology
8. Symptoms referable to the throat	8. Chronic airways obstruction	8. Haematology
9. Abdominal pain, cramps, spasms	9. Asthma	9. Pneumonology
10. Headache, pain in the head	10. Bronchitis	10. Rheumatology
11. Upper respiratory infection (head cold, coryza)	11. Neurotic disorders	11. Allergology/immunology
12. Back symptoms	12. Angina pectoris	12. Neurology
13. Vertigo, dizziness	13. Chronic sinusitis	13. The consultation
14. Shortness of breath	14. Acute pharyngitis	14. Primary care
15. Tiredness, exhaustion	15. Cardiac dysrhythmia	15. Geriatrics
16. Leg symptoms	16. Miscellaneous (diagnosis missing or illegible)	
17. Shoulder symptoms	17. Other disorders of soft tissue	
18. Neck symptoms	18. Other respiratory symptoms	
19. Ischaemic heart disease	19. Peripheral enthesiopathies	

"classical" discipline-focused textbook approach with its focus on organs and their pathologies (Table 11.1, third column from Zollo, 5pp).

As a family medicine resident, this table evoked a great deal of dissonance, does the discipline really have three sources of knowledge:

- One arising from the epidemiology of *reasons of encounter*
- One given by the weights attributed to them by the "experienced physician"
- One that satisfies examiners of students and vocational trainees

This observation of a possible *triple knowledge* about family medicine raised the following research question (and became the topic of my PhD project):

> What kind of relationship exists between the epidemiology of illness experience, a GP's/FP's knowledge base to manage those illnesses and the knowledge expected of vocational trainees as represented in Family Medicine's vocational exam questions?

11.2 What Was Known?

Preliminary reading of the literature showed no data to directly compare the family medicine training programmes and examination formats either between European countries or internationally with, e.g. the USA or Australia.

11.2.1 Towards a Theoretical Framework

This study developed a theoretical framework based on empirically derived data, heuristics and data extracted from actual specialist examinations.

- **Empirical data**
  In the absence of empirical studies, a normative article by Braun and Halhuber [3] offered a "functional clinical thought and action framework based on clinical experiences", an approach that proved to be reliable even in the absence of "clinical disease".
- **Study samples**
  Examination questions from two German states[1]—Lower Saxony and Bavaria—were collected for comparison purposes and correlated to three paradigmatic frameworks of family medicine: Balint's relationship theory, Braun's professional theory and Cochrane's evidence-based medicine.
- **Exam topic clusters**
  Seven of the ten most common topics covered in the specialist exams in Lower Saxony and Bavaria (Table 11.2) show clustering around two threads—prevention (measles, vaccinations, undescended testis) and chronic disease (diabetes, hypertension, osteoporosis and elderly patients).
  The two samples are comparable across the seven most frequent topic domains—note the overlaps of topics of prevention with osteoporosis and geriatrics with diabetes.
  However, the 10 topics of the examination are twice as frequently in Bavaria compared to Lower Saxony.

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[1]GP vocational examinations in Germany.
Because of the country's federal structure, the format of the vocational examination differs slightly between states but has a common structure: its format is oral, takes place at the local boards and lasts 40 min. The panel consists of three examiners (a chair from another speciality and two general practitioners). Questions are introduced in the form of patient-centred vignettes. As the number of main topics is limited, case vignettes are similar across exams. The questions about the case cover multiple clinical domains.

Table 11.2 Exam inventory—ranking of topics, frequency of questions and consistency across exams

Ranking of topics (Lower saxony 2005–2006)	No of questions[a] (%)	Consistency of topic across exams[b]	Ranking of topics (Bavaria 2003–2005)	No of questions[c] (%)	Consistency of topic across exams[d]
Diabetes mellitus—Types I and II	50 (2.8%)	18.6%	Acute coronary syndrome	35 (10.0%)	140%
Hypertension	42 (2.4%)	15.6%	Prevention (osteoporosis)	34 (9.7%)	38%
Measles	37 (2.1%)	13.7%	Geriatrics (Type II diabetes)	26 (7.4%)	29%
Signs of death	35 (2.0%)	13.0%	Vaccinations	14 (4.0%)	16%
Acute coronary syndrome	34 (1.9%)	12.6%	Measles	10 (2.8%)	11%
Vaccinations	32 (1.8%)	11.8%	Hypertension	10 (2.8%)	11%
Prevention (osteoporosis)	31 (1.7%)	11.5%	Diabetes mellitus–Types I and II	6 (1.7%)	7%
Geriatrics (Type II diabetes)	29 (1.6%)	10.7%	Lyme disease	4 (1.1%)	4%
Undescended testes	28 (1.6%)	10.4%	Undescended testes	–	–
Lyme disease	27 (1.5%)	10.0%	Signs of death	–	–
Total	345 (19%)			139 (40%)	

[a]1778 questions
[b]269 examinations
[c]350 questions
[d]89 examinations

11.3 The New Approach: Professional Levels, Equivalents of Knowledge, and Bibliometric Method

A different approach to understanding the knowledge of GP/FM was inspired by a sociological perspective. Complexity of professional knowledge, as addressed by Abbott [4], means that each professional level of expertise repeats the knowledge of the profession fractally. Importantly distribution patterns of topics of the overall expertise are repeated by the distribution pattern between the "levels of expertise" in a self-similar fashion.

Based on the considerations by the German Association of Family Medicine (DEGAM) [5] and Braun [6], the knowledge base of GP/FM can be framed from three different perspectives (or domains):

1. Its underlying scientific basis
2. Its praxis
3. Its epidemiology

Based on these different perspectives, one would expect different levels of concordance between the topics explored in the exam and the GP/FM knowledge base assessed.

11.3.1   New Questions Emerged

These considerations raised four new questions:

1. Are there differences between exam topics and knowledge domains?
2. Which domain shows the highest level of concordance with the exam topics?
3. Are there "nested hierarchies" within some of the domains' knowledge that repeat themselves in a fractal pattern?
4. What can be said about the quality of the vocational exam based on the distribution of the topics covered in the exam?

These questions have been methodologically approached based on grounded theory (GT) as described by Strauß [7] and further refined by Reichertz [8]. GT arose in the qualitative domains of social research to explore and categorise the content of interviews and conversations—in this context, exam questions. GT organises materials based on their inherent properties (grounded) and then interprets these for their meaning (theory).

This approach uses deductive, inductive and abductive reasoning (as described by Reichertz [8]) to interpret the material and to reach logical and reproducible conclusions. This will be further explored in Sect. 11.6 in relation to this research.

It is not surprising that Strauß pointed to the usefulness of this method to reduce and understand complexities. This study aimed to discover "inherent patterns" in the "conversations of the examination material" and quantified by bibliometric approaches.

Bibliometrics[2] is a method to compare textual elements—in this study the comparison between examination topics and the knowledge domains of GP/FM [9]. The evaluation is carried out by comparing the fit between the exams' knowledge domains against its body of knowledge (pages in a textbook, frequency of topic in journals/year and general practice conferences [9]).

If there is a high concordance between the exam content and the discipline's underlying textual corpora in its scientific, praxis and epidemiological texts, it is worthwhile to compare these similarities quantitatively. High concordance between two comparative text corpora has been defined by Zipf [10] as "least effort" and by Polanyi [11] as the "law of poverty"; both terms arose in quantitative linguistics.

Quantitative linguistics [12] has shown that fictional and non-fictional texts have a fractal structure. Their constituent elements (letters, words, punctuation marks,

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[2]Bibliometrics is the statistical analysis of written publications, typically used to explore the impact of those publications on the development of the field.

etc.) have a repetitive pattern, where the patterns at every scale repeat that of the whole text in a self-similar way.

Fractal linguistics states that concordance between a reference text (here the exam question catalogue) and a comparative text (here the discipline's main textbooks, guidelines, journal and conference contributions) is greater if a smaller rather than a larger amount of comparative text is needed to show concordance. Put differently, if a small amount of comparative text already shows the fractal pattern of self-similarity with the reference text, it conveys this message with the "least effort".

11.3.2 Comparing Corpora

The exam topics of the Lower Saxony and Bavarian general practice specialist examination were analysed for the knowledge covered across its professional domains: science, praxis and epidemiology. Comparative corpora, according to Fleck [13], include textbooks, periodicals and abstracts. The resources examined included:

- Science

  1. Textbooks
     For the period 2004–2007, "Google Books Ngram Viewer" [14] identified Kochen [5] and Mader and Weißgerber [15] as the most commonly used textbooks. According to N. Donner-Banzhoff, these textbooks can be taken as examples of the two main mental models of family medicine—a "strictly EBM" (anglophil or "atlantic") (Kochen [5]) and a "professional theory" ("continental")-oriented framework (Braun and Mader [16]) that remains influential in Germany and many European countries [17].
  2. Journal articles and abstracts
     For 2004–2007, we drew on the ZfA[3]-Archive [18] and the ZfA-Abstracts of the DEGAM Congresses 2004–2007 [19] as representing the leading periodical and congress of German family medicine.

- Praxis
  The corpora describing the praxis of GP/FM include DEGAM guidelines [20], European EBM guidelines for family medicine [21], the diagnostic protocols according to Braun's continental "Berufstheorie" [6] and a question bank generated by examiner participant observers [15].

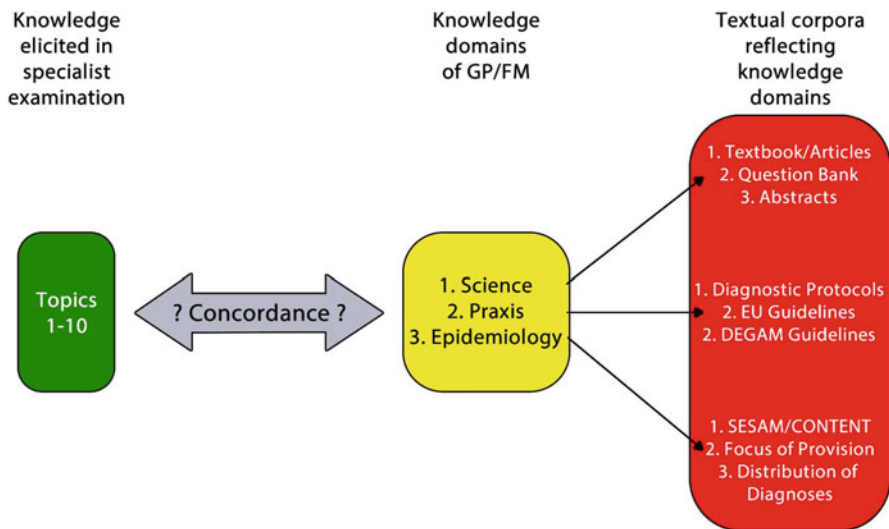[3]ZfA—Zeitschrift für Allgemeinmedizin is the Official German General Practice/Family Medicine Journal.

Fig. 11.1 HOW much are the exam questions concordant with the disciplines principle knowledge. For an examination (green box) to be valid, it has to represent its knowledge domains (yellow box) through its written textual *corpora* (red box)

- Epidemiology

  The epidemiology of German GP/FM was extracted from the *CONTinuous morbidity registration Epidemiologic NeTwork* (CONTENT) study [22] for the time period 2004–2007 and from the *Sächsische Epidemiologische Studien in der Allgemeinmedizin* (SESAM) [23] for the period 1999–2002.

  Figure 11.1 summarises the research question highlighting HOW much are the exam questions concordant with the discipline's principle knowledge base as mapped against its knowledge resources.

11.4 Outcomes

The concordance of examination questions to the GP/FM knowledge base is summarised in the following tables, and important deviations are highlighted.

11.4.1 Science

The science-based knowledge domains have been separately analysed for each source.

Table 11.3 Coverage of exam domains in textbooks

Ranking of topics	Kochen[a] [5] No of pages (%)	Mader and Weißgerber[b] [15] No of pages (%)	Mader/Weißgerber[c]—need-to-know-questions [15] No of questions (%)
Diabetes mellitus—Types I and II	12 pp (1.92%)	15 pp (3.08%)	48 (3.27%)
Hypertension	12 pp (1.92%)	10 pp (2.05%)	23 (1.57%)
Measles	4 pp (0.64%)	2 pp (0.41%)	5 (0.34%)
Signs of death	–	2 pp (0.41%)	11 (0.75%)
Acute coronary syndrome	4 pp (0.64%)	12 pp (2.46%)	21 (1.43%)
Vaccinations	17 pp (2.72%)	18 pp (3.69%)	19 (1.15%)
Prevention (osteoporosis)	6 pp (0.96%)	4 pp (0.82%)	24 (1.46%)
Geriatrics (Type II diabetes)	30 pp (4.81%)	1 p (0.20%)	20 (1.21%)
Undescended testes	2 pp (0.34%)	1 p (0.20%)	5 (0.34%)
Lyme disease	4 pp (0.64%)	2 pp (0.41%)	11 (0.75%)
Total	91 pp (14.58%)	67 pp (13.75%)	187 (12.75%)

[a]624 pages
[b]487 pages
[c]1467 questions

1. Textbooks (Table 11.3)

    Both of the textbooks cover all of the topics. The top topics diabetes and hypertension are described in both textbooks [5, 15]. There are differences in the composition of other high ranks.

    Signs of death are absent but geriatrics are more extensively dealt with by Kochen [5], while myocardial infarction is more extensively dealt with by Mader and Weißgerber [15]. Mader's question bank does not cover his textbook content evenly as its questions were generated by the authors as examiner participant observers. Therefore its content—though incorporated inside a textbook—reflects praxis knowledge. The top 10 exam topics are covered by 13% of this question bank.

2. ZfA journal articles 2004–2007 (Table 11.4)

    Four of the ten top examination topics are covered in all 4 years of the observation period, and two are covered in 2 of the 4 years, and three domains are not covered at all. The journal provides extensive coverage of osteoporosis (overlapping with prevention) and to a lesser extent geriatrics (overlapping with Type II diabetes). Notably, prevention (rank 7) and geriatrics (rank 8) are significantly overrepresented in the journal. Despite this skewed distribution, 13–26% of the journal articles covered the top 10 examination topics through 2004–2007.

Table 11.4 Coverage of exam domains in ZfA publications

Ranking of topics	ZfA 2004[a]	ZfA 2005[b]	ZfA 2006[c]	ZfA 2007[d]
Diabetes mellitus—Types I and II	3	2	1	3
Hypertension	2		2	
Measles				
Signs of death				
Acute coronary syndrome	1		1	
Vaccinations	1	1	1	3
Prevention (osteoporosis)	12	6	8	6
Geriatrics (Type II diabetes)	1	6	1	5
Undescended testes				
Lyme disease				1
	26%	13%	14%	20%

[a]76 articles
[b]111 articles
[c]99 articles
[d]90 articles

Table 11.5 Coverage of exam domains at DEGAM meetings

Ranking of topics	DEGAM abstracts 2004[a]	DEGAM abstracts 2005[b]	DEGAM abstracts 2006[c]	DEGAM abstracts 2007[d]
Diabetes mellitus—Types I and II	2	1	2	5
Hypertension	2	4	3	1
Measles				
Signs of death				
Acute coronary syndrome	1	1	1	1
Vaccinations				1
Prevention (osteoporosis)	5	9	8	13
Geriatrics (Type II diabetes)	4	7	8	10
Undescended testes				
Lyme disease				
	19%	30%	29%	40%

[a]80 abstracts
[b]74 abstracts
[c]76 abstracts
[d]78 abstracts

3. DEGAM conference abstracts 2004–2007 (Table 11.5)

   Five of the top 10 topics are covered at every conference, one topic is covered once, and four are not covered at all. Again, prevention (rank 7) and geriatrics (rank 8) are significantly overrepresented. 19–40% of the conference presentations covered the top 10 examinations from 2004–2007.

11.4.2 Praxis

The praxis of GP/FM covered by the top 10 exam topics has been compared to the DEGAM [20] and EBM guidelines [21] as well as Braun and Mader's [16] diagnostic protocols (Table 11.6).

Probably unsurprisingly, DEGAM [20] and EBM guidelines [21] covered the praxis of GP/FM by means of only 5% and 8% of the page numbers, respectively. Braun and Mader's [16] diagnostic protocols, while covering eight of the ten top examination topics, dealt with the praxis of GP/FM in 15% (Table 11.6).

Table 11.6 Coverage of exam domains in guidelines and diagnostic protocols

Ranking of topics	DEGAM-LL guidelines[a] [20]	EBM guidelines family medicine[b] [21]	Diagnostic protocols[c] 2005 [16]
Diabetes mellitus—Types I and II	GL4-1 GL8-1 GL9-1	40	7
Hypertension	GL4-1 GL8-1 GL9-1	19	7
Measles		2	1
Signs of death		2	
Acute coronary syndrome	GL8-1 GL9-2	24	84
Vaccinations		7	1
Prevention (osteoporosis)	GL4-1	17	3
Geriatrics (Type II diabetes)	GL4-1 GL6-2 GL9-1	7	3
Undescended testes		2	
Lyme disease		8	12
	14/273 = 5%	128/1583 = 8%	43/302 = 15%

[a]273 pages of guidelines
[b]1583 pages of guidelines
[c]302 pages of diagnostic protocols

11.4.3   Epidemiology

The knowledge domains tested in the exam and their occurrence in GP/FM have been mapped to the frequency data of two epidemiological studies—CONTENT [22] and SESAM [23]. As in the epidemiology domain the only text type is "diagnosis", there is no other possibility to look for hierarchies than inside of this text type. Diagnoses were coded in ICPC-2.

One exam topic can be coded by more than one ICPC-2 code, e.g. measles as (A71) or as vaccination (A—general procedures) or diabetes I/II as (T89, T90) or as prevention (A—general/prevention). Coding differences thus result in differences in frequency between CONTENT [22] and SESAM [23], 68% reasons for encounter [22] and 32% of diagnosis for consultations [23]. The cumulation of A-, K- and T-diagnoses (prevention, circulation, metabolism) in the exam topics of diabetes, hypertension and related subjects (prevention, geriatrics) shows a high fit with general practice epidemiology; K- and T-diagnoses increase to 60% in CONTENT [22] and SESAM [23] for geriatric patients (Table 11.7).

11.5   Comparing Corpora

The match between exam topics and the discipline's textual corpora ("rank of fit") showed to be proportional to the number of topics assessed in the exam ("hit rate") and to be inversely proportional to the number of textual elements in the textual corpora that define the profession's knowledge base ("textual effort"). The latter displays the textual properties of Zipf's "least effort" [10] and Polanyi's "law of poverty" [11] (see Sect. 11.1—bibliometrical criteria of concordance).

Another way of comparing exam topics and the discipline's knowledge base looks at the number of times an exam topic appears in the discipline defining textual corpora (i.e. its "hit density").

If we consider the "hit rate" and "textual effort" as criteria for the fit between exam topics and the textual corpora of the knowledge domains, we see an overall descending hierarchy of concordance between praxis, science and epidemiology as follows (Table 11.8):

- praxis: as defined by EBM guidelines [21] and Mader/Weißgerber's question bank [15]
- science: as defined by Mader and Weißgerber's [15] and Kochen's textbooks [5]
- epidemiology: as found in the CONTENT survey [22]

We also see descending hierarchies inside the praxis-level corpora:

- EBM guidelines [21]
- Braun/Mader's diagnostic protocols [16]
- DEGAM guidelines [20]

Table 11.7 Coverage of exam domains compared to their epidemiological frequency in CONTENT [22] and SESAM [23]

Ranking of topics	Represented by ICPC-2 chapters	SESAM 2002	CONTENT 2007
Diabetes mellitus—Types I and II	T endocrine, metabolic and nutritional	5.6%	3.2%
		T34, T63	T90, T93
Hypertension	K circulatory	13.4%	4.1%
		K31, K50, K63	K86
Measles	A general and unspecified-A71	–	–
Signs of death	A general and unspecified-A96	–	–
Acute coronary syndrome	K circulatory-K75	–	–
Vaccinations	A general-procedures	3.5%	2.6%
		A44	A98
Prevention (osteoporosis)	A general-prevention	25.0%	12.1%
	L musculoskeletal	(A44), A63	A98
	K circulatory	K31, K50, K63	K86
	T endocrine, metabolic and nutrition	L01, L02, L03	L86
		T34, T63	T90, T93
Geriatrics (Type II diabetes)	A general-preventions	20.7%	9.9%
	K circulatory	(A44), A63	A98, K86
	T endocrine, metabolic and nutrition	K31, K50, K63	T90, T93
		T34, T63	
Undescended testes	A general-preventions-A98	–	–
	Y male genital system-Y83		
Lyme disease	A General-A78	–	–
	S Skin-S12		
Total		68.2%	31.9%

the science-level corpora:

- Mader/Weißgerber's question bank [15]
- Mader and Weißgerber [15] and Kochen's textbooks [5]
- ZFA themes [18]
- DEGAM abstracts [19]

and the epidemiology-level corpora:

- predominance of prevention in the geriatric population in both CONTENT [22] und SESAM [23]

Table 11.8 Coverage of exam domains in the discipline's knowledge corpora

Rank of fit between exam topics and textual corpora	Textual corpora and professional levels represented by …	Hit rate: Number of topics covered amongst the top 10 topics	Textual effort: Number of textual elements representing GP/FM (%)	Hit density: Number of times topic being mentioned in the corpora
1	EBM guidelines 2007 [21]; praxis	10	8	15
2	Mader/Weißgerber question bank 2005 [15]; praxis	10	13	19
3	Mader/Weißgerber textbook 2005 [15]; science	10	14	6.7
4	Kochen [5]; science	10	15	10
5	Braun and Mader [16]; praxis	8	15	5
6	ZfA 2004-7 [18]; science	5	18	3.2
7	DEGAM Guidelines 2004–2007 [20]; praxis	5	5	2.8
8	DEGAM Abstracts 2004–2007 [19]; science	5	29	4.3
9	CONTENT 2007 [22]; epidemiology	5	32	2.6

11.6   Discussion

The questions of this project (Sect. 11.3.1) are initially answered at the level of comparisons (Sect. 11.5 and Table 11.8). There is a descending hierarchy of concordance between the exam question catalogue and the discipline's texts:

• Praxis
• Science
• Epidemiology

In addition we found a descending hierarchy of concordance within the texts representing each knowledge domain and the exam question catalogue:

• Praxis

  – EBM guidelines [21]
  – Diagnostic protocols [16]
  – DEGAM guidelines [20]

- Science

  - Mader/Weißgerber's question bank [15]
  - Textbooks [5, 15] and journal articles [18]
  - Conference abstracts [19]

- Epidemiology

  - Focus on prevention and geriatrics [22, 23]

Looking at the hierarchies of the corpora of each knowledge domain as a representation of that knowledge domain as suggested by Abbott's [4] "theory of fractal knowledge of disciplines", we find a fractal pattern between the discipline's knowledge domains and the exam question catalogue:

- Within the **praxis-level corpora**, EBM guidelines [21] represent the highest standard of praxis knowledge by European consensus, the diagnostic protocols by Braun and Mader [16] the high-level science domain and the "still young" DEGAM guidelines [20] the uncodified praxis knowledge most needed to answer epidemiological concerns
- Within the **science-level corpora**, the Mader/Weißberger question bank [15] represents praxis knowledge, the textbooks [5, 15] and journal articles [18] the scientific knowledge and the conference abstracts [19] still uncodified knowledge applicable to epidemiological questions
- The **epidemiology-level corpora** focus entirely on the diagnostic processes (as represented by the symptom chapter A- of ICPC) and diagnoses with a special focus on the K- and T-chapters [22, 23] and with a predominance on the geriatric-aged group

Figure 11.2 summarises the findings of the hierarchical patterns of concordance between the exam question catalogue and the texts that describe the three domains of knowledge and their repeated pattern within the corpora of each knowledge domain. This pattern shows the fractal pattern of nested self-similarity (as outlined in Sect. 11.3.1).

Metaphorically one can describe the knowledge base of general practice as a *Russian doll*—its innermost core being the discipline's epidemiology. Using the language of qualitative social sciences, the *Russian doll* metaphor translates: the exam question bank has a descending concordance pattern between praxis, sciences and epidemiology; the pattern is fractally repeated within the texts of each knowledge domain.

These findings were found deductively. Following Abbott's [4] rules, the data of this study confirmed the theory of the fractal pattern defining a discipline.

The answers to the emerging questions posed in Sect. 11.3.1 are as follows:

1. The exam question bank and the themes of the representative texts of each knowledge domain show a descending pattern of concordance between praxis, science and epidemiology
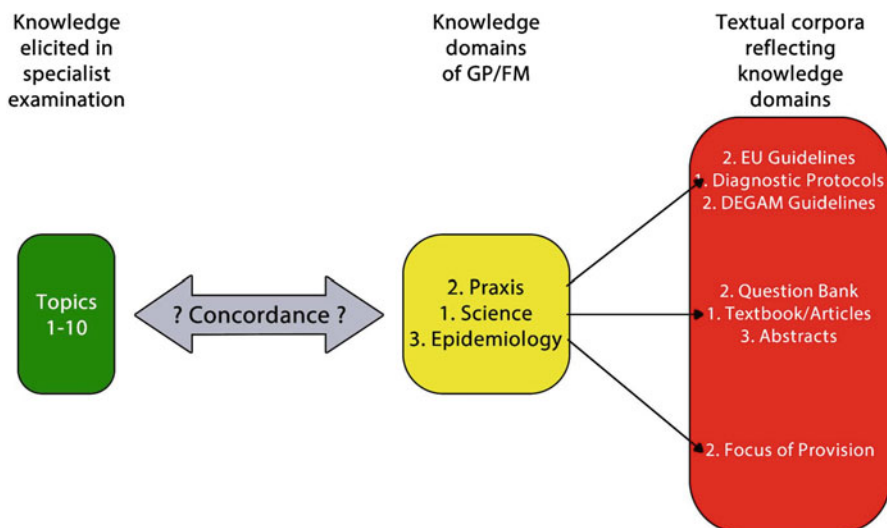
Fig. 11.2 The fractal nature of general practice knowledge in the postgraduate examination. The examination (green box) indeed shows to represent the disciplines knowledge domain to have a fractal pattern (yellow box) and that each knowledge domain entails a fractal pattern of the disciplines overall knowledge as represented in its written textual *corpora* (red box)

2. EBM guidelines [21] show the highest level of concordance within the praxis-level corpora, and the Mader/Weißberger question bank [15] shows the highest level of concordance within the science-level corpora
3. The descending patterns of concordance within the praxis, science and epidemiology domains repeat themselves fractally (nested self-similarity)
4. The high level of concordance between the exam question bank and both the EBM guidelines [21] and practice epidemiology [3, 22, 23] attests a high level of "internal validity" of the exam question bank

11.7 Conclusions

The demonstrated complexity inherent in the general practice knowledge base raises at least two other aspects that deserve further exploration:

- GP/FM in Germany has a strong focus on prevention. This focus is reflected in the postgraduate examination; there is a high level of concordance between the exam question bank and EBM guidelines and general practice epidemiology.
- This pattern emerged without formal training of examiners or the evaluation of the examination itself. Such complex adaptive patterns are typical for general practice activities and have been previously described by Ellis [24]. To explore these issues further, it would be useful to initiate an international comparative study.

This research over a 10+ year period with its complex outcomes had a significant personal effect.

- It triggered the feeling of a "journey" (in old German, "queste") with an uncertain destination, nevertheless worth to pursue
- It triggered the feeling that one wound find a coherent background despite the obvious chaotic foreground [25]

Feelings of a "journey" as well as the sense of certainty of a coherent background despite a chaotic foreground—in psychodynamic terms—arise primarily from a perspective [26]. This emotional aspect of scientific work in complexity research has been emphasised by Kissling et al. in their work of transforming internal body images into externally visible pictures—or art [27].

The Journey

I tried to understand the complex interactions of daily practice, which I neither understood nor mastered despite extensive psychotherapeutic studies and Balint experiences—that was what started my journey into complexity sciences. It was a qualitative, linguistically oriented research project that allowed me to create a coherent structure of my practice experience under the umbrella of "narrative-based medicine". Thure von Uexküll's biosemiotic model [28] provided the essential framework for a lot of studies concerning doctor-patient interactions, effects of complementary treatments and the placebo effect itself.

Following my habilitation, I found myself working in a large, mainly geriatric, rural practice with its high levels of diagnostic uncertainty. I aimed to understand and research these daily experiences based on the classical approaches of Braun's complexity categorisations. I linked up with the remaining Braun pupils Frank Mader, Waltraud Fink und Gustav Kamenski and the Karl Landsteiner Institut, Vienna. This ongoing collaboration has resulted in a series of joint publications. This work linked me to Joachim Sturmberg and his "complexity tribe" with which I feel connected, and I am curious to see how this journey will progress.

Take-Home Message

- The knowledge base of general practice/family medicine encompasses three knowledge domains—praxis, science and epidemiology
- The final postgraduate examination for general practice/family medicine in Germany reflects the knowledge domain of the discipline
- The knowledge domains show a fractal pattern between its components

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