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18 19 20	Faraz has an enduring relationship with academia and research which encompasses basic sciences, molecular biology, to health professions education. His research interests include metacognition, threshold concepts, and learning environment.
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22	Running title: Practical Tips on Methods for Abductive Thematic Analysis
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28 Title: Navigating Thematic Analysis: Practical Strategies Grounded in Abductive

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Reasoning

30 Abstract

Abductive thematic analysis blends empirical observations with theoretical frameworks, 31 fostering a continuous and dynamic exchange between research evidence and theory. It 32 is distinct from other forms of analysis as it is underpinned by pragmatism and is flexible 33 in its adoption of theory in order to best answer the research question. As a result of an 34 interplay between theory and data, a surprising, puzzling, or anomalous finding may lead 35 to new insights. This flexible approach to theorisation can draw from existing theories 36 dependent upon what is best able to explain the data. This results in a theoretically-37 38 informed explanation for empirical phenomena, which may in-turn unveil unique insights 39 about existing theories, making it a valuable tool across diverse research domains in medical science. The guidelines in this paper aim to illuminate abductive thematic 40 41 analysis, steering new researchers through each step, maximizing novel theoretical contributions and fostering a comprehensive understanding for researchers and educators. 42

43 Key Words: Thematic Analysis, Abductive Reasoning, Defamiliarization, Qualitative
44 Research

45 Introduction

Drawing on the three categories of logical reasoning Peirce asserts, "Deduction demonstrates what must exist, induction reveals what is currently functioning, while abduction simply proposes possibilities".¹ Consider a medical educator, Alex, investigating the reasons for prescribing errors among young doctors. Based on existing evidence, Alex hypothesizes that errors are linked to limited experience and excessive reliance on clinical decision support tools. Through testing hypotheses, Alex deduces that the errors stem from lack of experience and over-reliance on technology.² Further 53 research into junior doctors' experiences, gathered through exploratory qualitative methods, led Alex to infer that high-stress environments and inadequate support are 54 additional factors contributing to prescribing errors, beyond the tested hypothesis.³ 55 56 Through abductive reasoning, Alex came to the plausible inference that junior physicians frequently encounter challenges in their decision-making processes, as they rely 57 predominantly on tacit heuristic knowledge and intuitive judgment, without engaging in 58 deliberate reflection.^{4,5} Consequently, they may inadvertently omit critical information 59 that would be beneficial for rational prescribing, potentially leading to prescription errors. 60

A closer delineation of logical trajectories aids researchers in aligning their methods with 61 their research goals, thus informing the data analysis process whether it's generating new 62 theories, testing existing ones, or exploring novel ideas. The flexibility in identifying 63 64 patterns and themes within a dataset through thematic analysis significantly depends on the approach taken.⁶ If thematic analysis is deductive and analyst-driven, then themes are 65 guided by extant theoretical or analytic frameworks involving focused analysis of specific 66 data aspects aligned with predetermined research questions.⁷ Although valuable for 67 testing hypotheses, as demonstrated by Alex who connected prescribing errors to 68 69 inexperienced junior doctors' over-reliance on decision tools, a deductive approach can constrain findings to the researcher's expectations, limiting theoretical innovation. This 70 approach can be extremely rigid oversimplifying unpredictable or random qualitative 71 72 data that does not fit the initial theoretical framework. A focus on pre-established hypotheses may limit researchers' exploration of alternative explanations by disregarding 73 relevant data as irrelevant noise.⁸ Whilst, thematic analysis is inductively driven by data, 74 75 the process unfolds with themes emerging organically, without pre-existing knowledge 76 or specific research questions. The analysis confines itself to defining patterns, such as "high stress leads to prescribing errors," as demonstrated by Alex without explaining the 77 underlying mechanisms or engaging with broader theoretical contexts. Though ideal for 78

generating theory, particularly when studying new phenomena without extant literature it
may also limit abstraction or generalization, without broader theoretical engagement.

Shifting focus toward novel solutions to practical problems, the 'creative leap' of 81 82 abduction enables researchers to go beyond traditional theorization by reinterpreting and advancing from mere description to deeper theoretical insights. The imaginative, 83 observation-based hypotheses facilitate researchers to explore multiple explanations, 84 fostering flexibility, creativity, and humility while linking practice with theory.⁹ 85 Exploring abductive possibilities in Alex's case expands the scope of analysis, offering 86 deeper insight into prescription-related errors. Unlike purely inductive or deductive 87 methods, abductive analysis allows for greater theoretical flexibility. Researchers can 88 engage with multiple theories and adjust their framework as they encounter new data. 89 90 This flexibility is crucial in education research, where emerging patterns may require shifting theoretical assumptions.⁸ A parallel is drawn between inductive, deductive, and 91 abductive reasoning, as shown in Table 1. 92

93 Table 1. A comparative overview of inductive, deductive, and abductive reasonings.



Abductive reasoning is imperative in medical education research for integrating practice 95 with theory. It focuses on starting with real-world educational practices encountered by 96 trainees, educators, and staff, acknowledging the messy and contextual nature of these 97 practices.⁸ To further illustrate abductive reasoning with a worked example, Veen and 98 Cianciolo (2020) exemplify how reframing a problem can yield new insights. Although 99 not explicitly stated, the three patterns of logical reasoning are evident, with the shift in 100 perspective reflecting a "frame of reference," which represents a "classic philosophical 101 move". In their example, a residency program director initially attributes residents' failure 102 to use the teach-back method, where patients explain back to confirm understanding to a 103 knowledge gap, leading to ineffective interventions. Reinterpreting the issue as a 104 motivational deficit, using inductive reasoning, also fails. Abductive reasoning then 105 suggests the root cause is role conflict—residents balancing learner and practitioner 106 roles.¹⁰ Hence, abductive reasoning enables researchers to go beyond surface-level 107 explanations, challenge assumptions, and uncover underlying causes, making it crucial 108 for tackling complex didactic challenges. Applied to pedagogical, curricular, or hidden 109

curriculum issues, it may reveal overlooked aspects of teaching and learning, driving
curriculum reform and enhancing pedagogical practices to create more inclusive and
effective learning environments.

113 Although abduction aligns with the aims of educational research, its process may be 114 unfamiliar to many medical researchers, as it diverges from other approaches. Figure 1 115 visually summarizes qualitative analysis methodologies, ranging from theory-driven to 116 inductive approach illustrating how each technique balances theoretical frameworks with 117 data-driven insights.



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Figure 1. Continuum of qualitative analysis approaches, ranging from theorydriven to inductive methodologies: 1. Content Analysis,¹¹⁻¹⁴ 2. Template Analysis,¹⁵⁻
¹⁷ 3. Thematic Analysis,^{7,18,19} 4. Discourse Analysis,^{11,20} 5. Grounded Theory,²¹ 6.
Interpretative Phenomenological Analysis (IPA),^{22,23} and 7. Narrative Analysis^{24,25}
Guidance and support for researchers are often limited and presented in complex

123 Outdance and support for researchers are orien infined and presented in complex 124 language, challenging newcomers to navigate. To address this, we provide insights and 125 general guidance on the methodological steps that inform abductive analysis, emphasizing the four quintessential steps i) Familiarization ii) Revisiting the phenomenon iii) Defamiliarization iv) Theorization or alternative casing supported by examples and personal experiences. We also simplify our practical guidelines into easyto-follow guidelines, illustrated with a diagram (Figure 2) highlighting each key phase of abductive thematic analysis. Figure 2 highlights the essential insights drawn from the comprehensive tips in the paper, offering effective guidance for each step of abductive thematic analysis.



Figure 2. Visual representation of each phase of thematic analysis using analogies i) Familiarization with sunny, cloudy and rainy climate, ii) Revisiting the diurnal cycle of the sun, including the patterns of change occurring over time, iii) Confronting everyday experiences as unfamiliar, such as observing the sun at night, leading to a deeper appreciation or rethinking of the phenomenon, iv) Using the prism as a metaphor or theoretical lens to analyze data through various theoretical frameworks, revealing alternative perspectives and insights as shown by the spectrum. For each phase, the complex tips discussed in the paper are distilled into simple clues to effectively guide each step of abductive thematic analysis

141

FAMILIARIZATION IS THE STEPPING STONE

Taking a thorough, reflective approach helps researchers to familiarize with their
observations, ensuring that no interactions they encounter are overlooked, while
simultaneously evolving theoretical sensitivity

145 *a-Familiarize with corpus and active reading*

Familiarization is the active process of immersing in data through re-reading and 146 transcribing to identify patterns and meanings.^{7,8} In the context of abductive analysis, it 147 paves the way for the transformative phase of defamiliarization, where researchers 148 actively challenge and rethink their assumptions, gaining deeper insights into the 149 phenomena. The immersive engagement of researchers with their observations through 150 coding and note-taking, builds a foundation to explore theoretical ideas and prepare for 151 deeper analytical processes.^{8,26} Coding and memo writing ensure a thorough 152 153 familiarization with the data to materialize ongoing reflections, preventing the forgetting of interactions once documented.^{8,27} 154

Qualitative data can exist as transcribed interviews, observational field-notes, archival 155 documents, web articles, scraped web data etc. Yet, regardless of data type, the process 156 of actively reading the data remains the same as it allows the reader to familiarize oneself 157 158 with the corpus, extracting meaning, and understanding narratives. If the analyst is the one collecting data, this offers a distinct advantage, as it allows the identification of areas 159 seeking additional detail and enables researchers to adjust their data collection methods 160 promptly.¹⁹ If working in teams, then areas of weakness or gaps in the data should be 161 brought to the attention of the researcher responsible for data collection if data gathering 162 is still ongoing. Given that flexibility and pragmatism are underpinning principles of 163

abduction, such changes to data collection procedures can be informed by gaps intheoretical explanation or by gaps in understanding from the data itself.

166 *b- Gain holistic understanding through theoretical familiarity*

Equally important is theoretical familiarity as suggested by Timmermans and Tavory 167 (2014) emphasizing the in-depth knowledge of multiple theoretical frameworks aids in 168 abductive reasoning and theory construction. This scope and sophistication of the 169 theoretical background enables researchers to become sensitized to nuances in the data, 170 aiding them in revisiting observations and recognizing unexpected data, which may 171 otherwise be overlooked and generate new insights. Extensive familiarity with existing 172 theories is essential at all stages of research, as it supports 'theoretical breadth', rather 173 than relying on a single framework. This approach-knowing the theory in the plural 174 sense—broadens one's ability to apply alternative theoretical "casings" to observations, 175 supporting the creative development of new hypotheses using abduction.²⁸ 176

The theoretical familiarity or sensitivity of the researcher informs the formulation of the 177 research question, helping to ensure that the inquiry remains focused on relevant issues 178 and avoids vague or arbitrary results. ^{29,30} The initial theoretical framework should serve 179 as a guide without overly limiting researcher exploration. Researchers should refrain 180 from manipulating data to conform to pre-existing hypotheses or established frameworks. 181 Instead, they should allow empirical observations to guide their understanding, 182 recognizing the dynamic nature of scientific inquiry. Remember, the goal is not to 183 discover a singular objective truth but to find the most logical, and useful explanation for 184 the phenomena under investigation.^{31,32} An abductive approach to data engagement helps 185 the analyst to remain open to unexpected findings and alternative explanations and be 186 ready and willing to acknowledge any "blind spots".⁹ Researchers should regularly 187

reflect on their preconceptions and be willing to adapt their theoretical understanding
based on emerging insights from the data.^{33,34}

190 *c-Immerse for detailed fieldwork descriptions*

Abductive data analysis emphasizes 'Thick description' of data which entails a full 191 fieldwork contextualization, including participant details and social settings. It is 192 instrumental in bridging empirical data with theoretical insights in abductive analysis. By 193 providing a richly detailed account, researchers are better positioned to explore 194 unexpected findings and to build or refine theories that closely reflect the data's context.²⁶ 195 A 'thick description' goes beyond the data corpus, offering a rich description for better 196 understanding the findings' transferability.35 A recent qualitative study commenced 197 through semi-structured interviews about identity formation in teenagers and young 198 adults with diabetes. The study's sampling method also focused on obtaining thick 199 descriptions of participants' demographic characteristics, social surroundings, and their 200 scores on the Danish Illness Identity Questionnaire (IIQ-DK). This approach enhanced 201 abductive analysis, yielding deeper findings about living with diabetes and perceptions 202 of identity, revealing themes of acceptance, rejection, and social dynamics, while 203 supporting theoretical refinement.³⁶ 204

A more robust approach to abductive analysis is guided by acquiring a thorough understanding of the context by becoming closely familiar with the culture, norms, and practices of the individuals or community being studied.³⁷ Providing a vivid portrayal of the context, participants, and social setting enables a profound connection with the realworld implications of empirical findings. This immersive approach enhances the relevance of research to various situations and contexts, increasing the likelihood of successful implementation of the recommendations.¹⁹

212

ITERATIVE PROCESS OF REVISITING DATA

- 215 The iterative process of moving back and forth between researchers' theoretical
 216 sensitivity and the data at hand, allowing the phenomenon under discussion to expand
 217 beyond its initial impression and open avenues for new insights.
- 218 *d-Revisit your observations & kickstart coding*

Abductive analysis is a method of re-examining empirical data from different 219 perspectives in order to gain new insights into it. Empirical observations/phenomena that 220 221 may not have seemed significant at the time can become valuable later on; revisit all observations regardless of whether they were recorded or not. Field notes, photographs, 222 and transcriptions are all useful tools for revisiting observations and experiences. 223 Different vantage points can shed new light on the same findings and aids in identifying 224 missed patterns, thus beginning the initial cycle of coding. Approaching observations 225 from diverse theoretical vantage points enriches insights, and being open to revisiting old 226 observations may unveil valuable new connections or insights²⁸. Revisiting observations 227 constitutes as the first step to data construction that runs as iterative cycle of data coding 228 in abductive analysis. 229

Deconstructing data into codes, the process entails generating concise representations of 230 language or visual data capturing their thought-provoking essence.³⁸ Coding initiation 231 which establish a direct link between raw data and cognitive interpretation ³⁹, should be 232 followed by at least 2-3 rounds of coding to thoroughly explore the data. Recognizing 233 that the initial round may not reveal all relevant codes ³⁸, code each point of significance 234 to extract maximum semantic meaning. ^{7,38} By adopting an abductive approach to 235 thematic analysis, a researcher should progress through these approaches to coding, 236 moving from open approaches (relying mainly on the raw data) to selective coding, where 237 prior research and understanding can begin to guide decision-making and comprehension. 238

Using multiple rounds of coding, Ingersgaard and colleagues analyze the identity 239 formation of young people with diabetes. Through two main rounds of coding, a 240 systematically organized data set was distilled. The first round yielded significant points 241 related to identity, guided by sensitizing concepts such as "inner-outer dialectics of 242 identification," "identity work," and "impression management".³⁶ These concepts helped 243 pinpoint relevant data within the broader context of identity formation. The second round, 244 consolidated codes and removed irrelevant or repeated ones, refining the comprehension 245 of patterns and relationships.³⁸ Revisiting the data during this stage ensured that key 246 247 insights were accurately captured allowing the authors to identify recurring patterns and anomalies within the participants' responses. This revisiting of the data/findings 248 enhanced understanding of their identity management in social contexts.³⁸ 249

250 Moreover, in the final coding round, using a codebook with concise labels closely tied to raw data enhances the rigor, clarity and organization of qualitative analysis by 251 emphasizing key features and narratives. ^{18,19,26} While some critics dismiss the codebook 252 in thematic analysis for being overly deductive and systematic, within an abductive 253 approach to analysis, the codebook serves as a tool to critically reflect and revisit 254 abductive reasoning rather than an objective measure of accuracy. Valuable for research 255 teams' internal discussions, the codebook transparently outlines coding steps, aiding 256 assessments by markers, examiners, and advisors.^{6,19,40} 257

258 *e-Allocate time for deliberation and reflection*

Setting aside specific time intervals for moments of reflection not only helps avoiding hasty judgments but also encourages a purposeful course of contemplating on the research evidence, making deliberation a crucial element of informed decisionmaking.^{41,42} Reflection involves consciously exploring the origins of one's theoretical thoughts, asking questions like "where did I get that idea?" This process allows researchers to discern influences, gain new theoretical insights, and potentially develop 265 new discoveries.⁴¹ Ensure clarity and coherence in the research process by dedicating

time to each critical step, promoting a thoughtful and comprehensive approach.

267

Engaging in activities like walking, reading, or listening to music can stimulate creative 268 thinking, enhancing the research process. Recognizing the importance of time allows 269 researchers to gain a nuanced understanding of evidence and produce thoughtful 270 analyses.⁴¹ Akin to Agatha Christie's spontaneous plot inspirations, the process involves 271 deliberation and reflective thinking. Christie's quote, "Plots come to me at such odd 272 273 moments, when I am walking along the street, or examining a hat shop...suddenly a splendid idea comes into my head"43, highlights that creative insights may emerge 274 unexpectedly. Deliberate review of data and openness to unforeseen connections align 275 276 with Christie's portrayal of the unpredictable genesis of her plots.

277

THINKING ANEW THROUGH DEFAMILIARIZATION

278 Defamiliarization reflects things taken for granted and lets us discern the same thing
 279 from different perspectives.

280 *f-Explore with familiarity, challenge with defamiliarization*

Defamiliarization is the practical process of achieving a fresh perspective on the research 281 work. Researchers needs be aware of their automatic ways of treating observations as 282 cases of rules, and de-automatize that process, ensuring that their findings are not biased 283 by preconceived notions or limited by existing rules. Defamiliarization, or 'estrangement,' 284 disrupts automatic thinking, especially in medical practice and education by: a) 285 Challenging Automaticity: Breaking free from patterns to avoid stereotyping, b) 286 Engaging in Thoughtful Perception: Perceiving things anew, delaying hasty conclusions, 287 c) Promoting Critical Inquiry: Encouraging questioning assumptions and terms, d) 288 Cultivating Reflection: Inserting moments for mindful practice, e) Harnessing Art: Using 289 art to appreciate individuality in healthcare interactions.⁴⁴ Medical professionals can gain 290

a greater appreciation for patients as individuals and cultivate a more humanisticapproach to healthcare by using art to make familiar elements strange.

Shifting perspectives towards data calls for considering unconventional angles, asking 293 probing questions, and exploring alternative interpretations, making the familiar 294 unfamiliar.⁴⁵⁻⁴⁷ Metaphorical exploration encourages using symbolic language to prompt 295 a departure from routine understanding.⁴⁵ Detail enhancement involves providing 296 meticulous descriptions to bring attention to typically unnoticed nuances. Introducing 297 temporal distance during analysis creates separation, offering a fresh perspective 298 returning to the data.²⁸ Researchers encouraged defamiliarization by shifting focus to 299 atextual sources, such as Zoom-generated footage, revealing subtle meanings and context 300 not captured in textual analysis.⁵ These practices collectively empower researchers to 301 navigate defamiliarization, unlocking new dimensions during abductive thematic 302 analysis. 303

304 While acknowledging the "defamiliarization surprises," Kleijberg et al. (2021) explored how intergenerational arts-based activities can foster community engagement with end-305 of-life (EoL) issues.⁴⁸ Making use of qualitative data in the form of interviews, 306 observations, and reflective notes, documenting changes in participants' perspectives on 307 mortality, the study highlights the participants re-examination of familiar concepts of 308 mortality, generating new perspectives on death and life through creative means. 309 Beginning abductive analysis using play theory iteratively, the researcher discovered that 310 these arts activities allowed participants to engage with sensitive topics in innovative 311 ways, although certain behaviors prompted an expanded interpretation of play theory, 312 especially in relation to mortality. These surprising findings emerged across various 313 themes, highlighting how arts-based activities can challenge entrenched views and 314 contribute to a more humanistic approach to EoL issues. The study concludes that such 315

316 activities hold promise not only for engaging communities but also for contributing to

theory-building in arts-related community engagement with end-of-life discussions.⁴⁸ 317

318 g-Strive to create meaningful themes

Like other qualitative analyses, differentiating between codes and themes is crucial in 319 abductive thematic analysis. Codes are precise, while themes involve a more complex 320 synthesis, combining various codes for theoretical interpretation. To develop themes 321 effectively: 322

- Explore Relationships: Analyze connections between codes, arranging them to 323 narrate the data's story.^{7,49} with these connections and explanations forming the 324 themes. 325
- Theme Labelling: Identify codes portraying a phenomenon and label it as a 326
- memorable theme. ^{7,50} 327
- Threshold for Themes: There is no specific threshold for codes to transform into 328 themes; all themes should encompass vital aspects for a comprehensive 329 understanding of story. ^{7,51} 330
- Theme Categorization: Optional, but scholars propose categorizing themes by 331 their significance.⁷ 332
- Informed by Theory: Most important within abductive research is enriching the 333 process with theoretical perspectives, utilizing concepts to guide theme 334 development.50 335

h-Identify theoretical misfits through data analysis and theory immersion 336

Theoretical misfits occur when the empirical data differs theoretically from what is 337 expected (i.e., variation, discordance, irregularities) based on our previous research, 338 knowledge, understanding, theoretical frameworks, or reading of the literature. When 339 conducting qualitative research, it is important to be aware that theoretical misfits may 340

not become immediately apparent as we immerse ourselves in a research site or literature.
These breakdowns, between data and theory should be addressed creatively by embracing
the iterative process of refining themes based on empirical findings and existing
literature.

Immersion is vital for researchers, fostering a profound understanding and yielding more 345 meaningful findings.⁴¹ Actively seeking and analyzing data helps uncover inconsistencies 346 or contradictions in theories or ideas being studied. Abductive reasoning, driven by 347 surprise and uncertainty, runs beyond empirical evidence or predefined hypotheses.⁵² 348 Unforeseen findings direct additional rounds of abductive analysis, not aimed at testing 349 hypotheses but embracing an ongoing creative process. The value lies in resistance to 350 initial coding as much as its affirmation. To achieve this, immersion in multiple theories 351 and careful field observations is necessary.⁸ 352

353 HONING THEORIES VIA RECURSIVE THEORIZATION AND
 354 ALTERNATIVE CASING
 355 Theorization refines theories based on data, while alternative casing explores
 356 different theoretical perspectives. Together, they advance theoretical understanding
 357 and guide abductive approach to data analysis.

358 *i-Navigate data toward theoretical evolution*

Theorization focuses on how existing theories relate to the data, while alternative casing explores new theoretical possibilities. Abductive thematic analysis, unlike deductive methods³⁰, guides themes without strict adherence to existing frameworks.⁵³ A crucial step in theorizing data is examining existing theories and frameworks to determine whether they are effective in explaining the relationships between the identified themes.²⁸ When themes do not align with existing literature, researchers may need to refine, adapt, or combine theories in order to better fit the data, ultimately defining the purpose of the

study.³⁰ When existing theories completely explain the findings, the study may be 366 regarded as confirmatory, with limited innovation.^{26,28} Nevertheless, even a small 367 observation or contextual difference in the data can result in new theoretical insights.⁵⁴ It 368 is critical that researchers connect theory with data and make modifications to the theories 369 when they fall short to ensure relevance to new contexts or research questions.^{54,55} 370 Moreover, alternative casing enhances theorization by exploring different ways to 371 categorize or frame a phenomenon. This approach allows researchers to test whether a 372 theory holds up across various theoretical perspectives or frameworks, potentially leading 373 to new theoretical developments or refinements.²⁸ The flexibility in abductive thematic 374 analysis allows adjustments to theories without merging perspectives or drastic 375 alterations.54 376

377 In essence, theorization and alternative casing work in conjunction to expand analytical insights and advance theoretical knowledge via iterative, multi-faceted examination of 378 empirical data. Abductive analysis involves the researcher engaging with theory and data, 379 producing theoretical conclusions (theorization). Khurshid et al,⁵ examined troublesome 380 and transformative concepts in pharmacology, guided by the theoretical foundations of 381 the threshold concept framework (TCF)56,57 aiming for an in-depth understanding of 382 cognitive changes underlying these concepts and their relation to core themes. When the 383 cognitive changes highlighted by these themes were not fully supported by the TCF, 384 abductive reasoning drew a parallel with Cognitive Load Theory (CLT).⁵⁸ Thus, the 385 386 theorization illustrates an intersection between CLT and TCF, offering better explanation 387 of data without starting from the ground-up in theory development. Similarly, an abductive analysis using a Vygotskian/TCF lens highlights the crucial role of conceptual 388 networks and critical thinking in transformative learning within evidence-based practice 389 and medical biostatistics education at an Australian university.⁵⁹ 390

391

392 *j*-Ensure trustworthiness of the process

In abductive thematic analysis, trustworthiness is ensured through fit, plausibility, andrelevance:

- Fit addresses whether theoretical claims are "backed up by the observations" and
 extend beyond simple description.⁸
- Plausibility involves examining whether alternative explanations might better
 account for the findings, often within a "community of inquiry".⁴¹ This includes
 the strategy of backward mapping, which enhances transparency by showing the
 rationale behind interpretations. Backward mapping traces the "logics-in hindsight" that led to specific insights, confirming the plausibility of an
 interpretation and reinforcing its credibility.^{41,60}
- Relevance assesses whether findings contribute meaningfully beyond the
 immediate study, supporting broader academic discourse.⁸
- 405 Unlike induction, which directly derives theories from data, or deduction, which tests 406 theories against data, abduction emphasizes a creative, iterative process. Through 407 "double-fitting" between data and theoretical frameworks, abductive analysis seeks "new 408 hypotheses" to explain surprising observations. This process enables abductive analysis 409 to address data complexities more flexibly than traditional inductive or deductive 410 approaches.^{8,41}

411 Conclusion

412 Abductive thematic analysis is slowly gaining attention in medical education, as it has in 413 other domains. However, confusion still surrounds its effective use in qualitative data 414 analysis. This robust approach to data analysis, demands advanced preparation and a 415 careful balance between theoretical engagement and methodological steps, thus 416 encouraging researchers to embrace a flexible approach to dynamic knowledge. The 417 practical insights discussed in this paper will help researchers new to this area engage in 418 more complex analyses that provide in-depth insights into data analysis, whether as a 419 novel experience or an unexpected anomaly. We recommend that repeated attempts at 420 data construction using these guidelines can help researchers arrive at the most plausible 421 explanations for empirical observations or phenomena. Additionally, it may facilitate 422 understanding the underlying mechanisms and contextual factors that play important 423 roles in shaping the observed phenomena.

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