



# Epidemiology and Diagnosis of Slow Learners (Borderline Intellectual Functioning)

So-Yeon Lee<sup>1,2</sup> and Keun-Ah Cheon<sup>1,2</sup>

<sup>1</sup>Department of Child and Adolescent Psychiatry, Department of Psychiatry, Severance Hospital, Yonsei University College of Medicine, Seoul, Korea

<sup>2</sup>Institute of Behavioral Science in Medicine, Yonsei University Health System, Yonsei University College of Medicine, Seoul, Korea

The definitions of “slow learners” and “borderline intellectual functioning (BIF)” have not reached a consensus and have continually evolved in terminology. The criteria for diagnosing BIF include the Full-Scale Intelligence Quotient, adaptive functioning, and onset of symptoms from the developmental period; however, specific standards have not been provided. Until the Diagnostic and Statistical Manual of Mental Disorders-IV, a range for the Full-Scale Intelligence Quotient was provided, but due to its limitations in reflecting the actual functioning of individuals with BIF, this criterion was removed from the Diagnostic and Statistical Manual of Mental Disorders-5. The absence of specific diagnostic criteria complicates the identification of individuals with BIF, highlighting the need for a more precise classification and definition.

**Keywords:** Borderline intellectual functioning; Slow learner; Adaptive functioning.

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**Address for correspondence:** Keun-Ah Cheon, Department of Child and Adolescent Psychiatry, Department of Psychiatry, Severance Hospital, Yonsei University College of Medicine, 50-1 Yonsei-ro, Seodaemun-gu, Seoul 03722, Korea  
Tel: +82-2-2228-1633, Fax: +82-2-313-0891, E-mail: kacheon@yuhs.ac

## INTRODUCTION

The term “slow learner” is predominantly used within the pedagogical sphere to denote children facing learning challenges due to cognitive limitations or psychological issues [1]. The definition of slow learner varies among researchers. As highlighted by Professor Ranjana from India, slow learners possess the same potential as their average peers and do not exhibit explicit disabilities. However, they encounter difficulties in academic achievement and daily activities, which necessitate additional time and effort. Unlike children who receive special education, slow learners must adapt to conventional educational systems[2]. This group is considered heterogeneous, encompassing specific learning disabilities (SLD), borderline intellectual disabilities, and attention deficit/hyperactivity disorders (ADHD). Children with borderline intellectual functioning (BIF) are commonly referred to as slow learners.

In the medical field, the concept and terminology of “BIF” have evolved over time. BIF is characterized by a limitation in intellectual capacity, which is attributed to various diverse causes. Alternative terms for BIF include borderline mental

retardation, slow learning, mild cognitive impairment, and general learning disability [3]. The perception of BIF has shifted from being recognized as a disability to being considered a factor that requires attention or a risk indicator for other disorders.

Consequently, the definitions and understanding of slow learners and BIF have continuously changed, leading to ambiguity and challenges in quantification. This has impeded research on BIF. In this study, we aimed to review the epidemiology of BIF, examine the evolution of its diagnostic criteria, and evaluate the current diagnostic standards and their limitations.

## METHODS

We aimed to review the epidemiology of BIF, with a particular focus on the prevalence, historical evolution of diagnostic criteria, and current diagnostic standards, through a comprehensive literature search. We conducted a literature search using the PubMed, Scopus, MEDLINE, and Google Scholar databases, covering publications from January 1950 to March 2024. All searches were limited to English language publications. The search keywords included “borderline mental retardation,” “borderline intellectual functioning,” “borderline intellectual disability,” “slow learners,” “general learning dis-

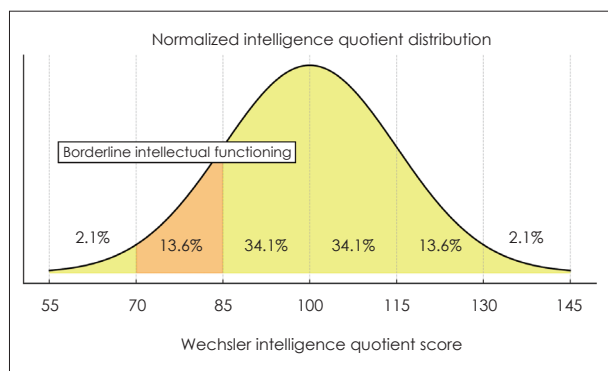
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ability,” “minor intellectual disability,” and “mild cognitive impairment.” Additionally, recognizing that keywords alone are insufficient to obtain comprehensive information on the epidemiology and diagnosis of BIF, we expanded our search to include changes in the diagnostic criteria for intellectual developmental disorders (IDD, also known as intellectual disability) for reference. This necessitated a review of the major psychiatric diagnostic standards, primarily focusing on BIF, including those from the Diagnostic and Statistical Manual of Mental Disorders (DSM), International Classification of Diseases (ICD), and American Association on Intellectual and Developmental Disabilities (AAIDD). We identified three review articles, 16 original research articles, and several textbooks. All the review articles are listed in the References section of the manuscript.

## EPIDEMIOLOGY

BIF was defined in DSM-IV and earlier classifications as being within -2 to -1 standard deviations (SDs) from the mean in the distribution of intelligence, equating to an intelligence quotient (IQ) range of 71 to 84 (Fig. 1) [4,5]. When considering the Full-Scale IQ (FSIQ) as the sole criterion, theoretically, this categorization could encompass 13.6% of the population owing to the properties of a normal distribution. However, when additional factors, such as adaptive functioning, are considered, the actual proportion of the population meeting the diagnostic criteria is likely to be lower.

Research on its prevalence among the general population is scarce, but a study targeting the general British population identified a prevalence rate of 12.3% [6]. The advent of the DSM-5 has seen a stagnation in research on prevalence, attributed to the revision of the BIF definition and the lack of quantifiable criteria, making it challenging to specify re-



**Fig. 1.** Normal distribution curve of intelligence in the general population. It has a mean of 100 and follows a standard deviation of 15. In DSM-IV, the borderline intellectual functioning was based on the standard deviation of -2 to -1, that is, IQ 71 to 84. DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, 4th Edition; IQ, intelligence quotient.

search participants. Additionally, studies on criminal populations have shown BIF prevalence rates ranging from 11% to 32.1% [7-9], with a notable prevalence of 18% [10] in individuals with polysubstance use disorders.

## DIAGNOSIS

Given that the hallmark characteristic of BIF is a deficit in cognitive functioning, it is crucial to consider IDD when diagnosing BIF. The diagnosis of IDD is not unified under a single system but is informed by three major diagnostic frameworks: the AAIDD, DSM, and ICD. All three systems emphasize the limitations in intellectual functioning and adaptive behavior, noting that these issues begin during the developmental period. This section explores how the definition of BIF has evolved and highlights the differences in the perspectives deemed considerable by each diagnostic system.

### Historical evolution

In the DSM-I, the range for BIF falls under the category of mild mental deficiency, with an IQ range of 70 to 85. By the time the DSM-II was published, it was referred to as borderline mental retardation (IQ 68–85) and included within a broader category of intellectual disorders [5,11,12]. This classification aligns with the 1961 framework proposed by the AAIDD, which categorizes IDD into five levels based on the IQ ranges: borderline, mild, moderate, severe, and profound.

Starting with DSM-III, BIF was classified under “V-codes for conditions not attributable to a mental disorder that are the focus of attention or treatment” [13]. Both DSM-III and DSM-IV allowed this code to be applied when the IQ range of 71 to 84 was the subject of clinical attention or treatment. From DSM-III onwards, it was noted that most individuals with BIF do not exhibit deficits in adaptive behavior, thereby excluding this range from being categorized as a “disorder.” BIF began to be treated as part of the normal intelligence range during this period.

The DSM-5 was a significant departure from previous editions in that it no longer provided a specific FSIQ range for BIF, unlike the DSM-IV (Table 1). In the DSM-5, BIF is included under the section “Other conditions that may be the focus of clinical attention.” This emphasizes the need for the careful evaluation of intellectual and adaptive functioning and their discrepancies, suggesting a shift in focus from IQ to adaptive functioning in order to distinguish BIF from mild IDD [14].

Another major change in DSM-5 involved adjusting the upper limit for IDD diagnosis to an IQ range of 65 to 75, considering the “standard error” of intelligence testing [15,16]. This adjustment implies that the previous borderline range

**Table 1.** Diagnostic criteria for borderline intellectual functioning in DSM-IV and DSM-V-TR**V62.89: Borderline intellectual functioning DSM-IV**

This category can be used when the focus of clinical attention is associated with borderline intellectual functioning, that is, an IQ in the 71–84 range. Differential diagnosis between borderline intellectual functioning and mental retardation (an IQ of 70 or below) is especially difficult when the coexistence of certain mental disorders (e.g., schizophrenia) is involved.

Coding note: This is coded on Axis II.

**R41.83: Borderline intellectual functioning DSM-V-TR**

This category may be used when an individual's borderline intellectual functioning is the focus of clinical attention or has an impact on the individual's treatment or prognosis.

Differentiating borderline intellectual functioning and mild intellectual developmental disorder (intellectual disability) requires careful assessment of intellectual and adaptive functions and their discrepancies, particularly in the presence of co-occurring mental disorders that may affect patient compliance with standardized testing procedures (e.g., schizophrenia or attention-deficit/hyperactivity disorder, with severe impulsivity).

DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, 4th Edition; DSM-V-TR, Diagnostic and Statistical Manual of Mental Disorders, 5th Edition, Text Revision; IQ, intelligence quotient

of 70 to 75 can also be considered within the spectrum of IDD. In the DSM-5-TR, while the definition of BIF remains consistent with DSM-5, the term “intellectual disability” has been changed to “intellectual developmental disorder,” aligning with the ICD and emphasizing that this condition begins during the developmental period.

The ICD-11, similar to the DSM-5, does not regard BIF as a diagnosable disorder but, unlike the DSM-5, continues to outline an FSIQ criterion ranging from -2 to -1 SDs, offering a clearer quantitative guideline [17].

### FSIQ

Since the AAIDD classified IDD into five levels (borderline, mild, moderate, severe, and profound) based on IQ ranges in 1961, the DSM has adopted this classification. Consequently, the FSIQ remains a crucial element in defining IDD and BIF. However, concerns have been consistently raised about interpreting FSIQ scores because of errors affecting IQ scores, imbalances between subtest scores and the FSIQ, and other factors [18]. Greenspan [16] highlighted that the division of IQ ranges for IDD and BIF, particularly the distinction based on SD units, was arbitrarily assigned for simplicity without any medical basis. This arbitrary classification detracts from a focus on an individual's capabilities.

In this context, the DSM-5 excludes the FSIQ criterion from the definition of BIF. However, this exclusion has led to criticism for not providing any concrete criteria for BIF, thus creating a dilemma in its classification and diagnosis.

### Adaptive functioning

Adaptive functioning represents an individual's capacity to function in everyday life, indicating that its impact on patients may be more critical than that of IQ tests. While there is a correlation between IQ and adaptive functioning [19], identifying deficits in adaptive functioning can be challeng-

ing at mild levels of cognitive impairment, necessitating the evaluation of adaptive functioning on its own [20].

Since Heber [21] first defined mental retardation in 1959, adaptive behavior has been a crucial element in defining IDD. The AAIDD [22], DSM-5-TR [14], and ICD-11 [17] similarly define adaptive behavior in three domains: conceptual, social, and practical adaptive skills. They agree that diagnosing IDD involves identifying significant limitations in adaptive behavior in at least one of these areas or a total score on adaptive behavior scales that is approximately two SDs below the mean (i.e., represented by a standard score of approximately 70 or less). Conversely, the absence of significant abnormalities in adaptive functioning may indicate BIF.

### Standardized assessment tools for adaptive functioning

In the past, the preference for the FSIQ over adaptive behavior in diagnosing IDD/BIF was partly due to a lack of adequate tools to objectively assess adaptive behavior. Recently, several standardized tools have been developed for this purpose.

Vineland Adaptive Behavior Scale (Vineland-3) [23]: Vineland-3 is the most commonly used tool for assessing adaptive behavior. It consists of three versions: an interview edition (birth to 90 years), a parent/caregiver form (birth to 90 years), and a teacher form (3 to 21 years). Vineland-3 evaluates communication, daily living skills, socialization, motor skills (optional), and maladaptive behaviors (optional).

Adaptive Behavior Assessment System (ABAS-3) [24]: ABAS-3 provides a parent/caregiver form (birth to 21 years), a teacher form (2 to 21 years), and an adult self-report form (16 to 89 years). It offers standardized scores for 11 adaptive skill areas covering conceptual, social, and practical domains.

Inventory for Client and Agency Planning [25]: It assesses adaptive behavior and behavioral problems. It offers stan-

standardized scores for adaptive behavior across four scales—social and communication skills, personal life skills, community life skills, and motor skills—and evaluates behavioral problems across eight domains.

Diagnostic Adaptive Behavior Scale [26]: Developed by the AAIDD, this scale is available for use in individuals aged 4–21 years. It measures aspects of adaptive behavior that are not currently assessed using other standardized instruments, including naiveté, gullibility, and technology-based skills.

In the DSM-5, the implementation of standardized tests for the evaluation of adaptive functioning is mandated. In cases where such testing is not feasible, a diagnosis of unspecified intellectual disability is recommended. Similarly, the ICD-11 stipulates the use of standardized tests for diagnosing IDD; when testing is impractical, it cautiously provides specific examples that can be referred to for the clinical estimation and evaluation of intellectual and adaptive capabilities (conceptual, social, and practical) across different age groups and levels of severity.

### Differential diagnosis

BIF presents with different symptoms depending on the age of the individual, and the conditions to be differentiated may also vary. During the preschool period, children with BIF often do not experience significant difficulties. However, at school age, children with BIF display a range of non-specific symptoms, including difficulties in academic achievement, reduced memory and concentration, impaired motor skills, less interaction with peers, and immaturity compared to their peers [3].

These symptoms can be observed not only in BIF but also in ADHD, specific learning disorders, autism spectrum disorder, and emotional issues, such as depression and anxiety. For differential diagnosis in school-age children, it is important to thoroughly review the developmental history, onset of clinical symptoms, accompanying symptoms, sequence of multiple symptoms, if present, and the caregiving environment. In addition to assessing FSIQ and adaptive behavior for diagnosing BIF, objective psychological tests that can differentiate between other suspected conditions may be necessary. These include developmental assessments, language evaluations, attention/executive function tests, social skills assessments, projective tests, and academic achievement tests.

The Wechsler Intelligence Scale For Children: Fifth Edition (WISC-V), in addition to the core indices of verbal comprehension, visual-spatial, fluid reasoning, working memory, and processing speed, also provides a general ability index (GAI). The GAI excludes the influence of working memory and processing speed from the FSIQ, which can help estimate a patient's overall potential FSIQ [27]. In addition to examin-

ing the GAI, comparing the subtest scores of the WISC-V to identify whether working memory and processing speed scores are significantly lower than those of other subtests can also aid in estimating a patient's potential FSIQ.

ADHD frequently co-occurs with BIF and is characterized by inattention, impulsivity, and hyperactivity. ADHD and BIF can be co-diagnosed and may mutually influence each other, further affecting learning and social adaptation. Although response rates may differ from those in cases of ADHD alone, the combination of ADHD and BIF can improve with stimulant medication, making proactive treatment recommended [28].

In the DSM-5, a specific learning disorder (termed learning disorder in the DSM-IV) is defined as having normal intelligence and adaptive behavior but experiencing difficulties in specific academic areas. By this definition, BIF and specific learning disorders should theoretically not overlap; however, many students categorized as having SLD in schools possess intellectual functions within the BIF range and exhibit significant adaptive functioning issues [16]. Thus, when distinguishing between these two conditions is challenging, conducting comprehensive learning tests and other assessments of academic abilities to identify areas of difficulty and provide tailored support is necessary.

In adolescence, children with BIF often experience difficulties in academic achievement and emotional issues, such as depression and anxiety, resulting from repeated failures. As in childhood, when emotional problems are the primary reason for seeking an evaluation, it is important to consider both the possibility that BIF underlies these issues and that emotional factors might influence the assessment, resulting in inaccurate BIF measurement.

In adults, when cognitive impairment is detected on assessment, the following factors should be considered when evaluating the likelihood of preexisting BIF [29]:

- That there is no history of chronic mental illnesses or cognitive deficits.
- History of chronic psychiatric medication use.
- Age range: To rule out the possibility of secondary cognitive deterioration, evidence that cognitive deficits start before 18 years of age must be provided.
- That there is no history of cranial trauma or secondary brain damage due to an incident or process of early dementia.

## CONCLUSION

In addition to identifying the major current issues in BIF diagnosis, we review the epidemiology and evolution of the diagnostic criteria for BIF. Although BIF is defined as a lack of significant abnormalities in adaptive functioning, distin-



guishing it from IDD, research indicates that individuals with BIF experience various daily living adaptation difficulties compared with those of the general population [30]. Additionally, compared with those of mild IDD, BIF demonstrates similar psychosocial and adaptive functioning deficits [31] and may present with more severe psychiatric issues [32]. This is presumably because individuals with BIF attempt to conceal their need for assistance and strive to act “normally [5,29].” Based on these facts, BIF, while not a disability itself, is associated with a higher probability of psychiatric disorders, complicating the diagnosis and treatment when such disorders arise [33].

The population with BIF, like those with intellectual disabilities, faces limitations in various life dimensions and requires specific attention in the social, health, education, employment, and legal areas [30]. However, because BIF has disappeared as a diagnostic category, these individuals are deprived of opportunities for appropriate assistance [34]. A more precise classification and definition of BIF are necessary for better “recognition” of individuals with BIF, enabling them to access better mental healthcare [33,35]. Considering these points, future definitions of BIF should include objectively measurable indicators that reflect the daily challenges faced by individuals with this condition.

#### Availability of Data and Material

Data sharing not applicable to this article as no datasets were generated or analyzed during the study.

#### Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

#### Author Contributions

Conceptualization: So-Yeon Lee, Keun-Ah Cheon. Supervision: Keun-Ah Cheon. Writing—original draft: So-Yeon Lee. Writing—review & editing: Keun-Ah Cheon.

#### ORCID iDs

So-Yeon Lee <https://orcid.org/0000-0002-3623-1439>

Keun-Ah Cheon <https://orcid.org/0000-0001-7113-9286>

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