



Identifying children at risk: Empowering teachers using the RedFlag app

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ARTICLE INFO

Keywords:

Technology
School based intervention
Early identification
Children at risk
Mental health
Disability identification

ABSTRACT

The present study evaluates a teacher training program that utilises an app-based screening tool to empower teachers to correctly identify children 'at-risk' for various developmental disabilities, mental health challenges and demographic challenges. A pre-post research design was used to assess the effectiveness for screening these risks with 1061 teachers who were recruited from three districts in Tamil Nadu, India. The teachers were asked to assess three case studies representative of children at -risk. Data collection was via software (Google forms) pretest. They were then trained in using the RedFlag App and were asked to reassess the same three case studies for likelihood of risk using the App. Results indicated a significant increase in the likelihood of correct assessment while using the RedFlag App (OR = 2,689, 95%, CI: 1.80–4.00). The improvements were significant across multiple demographic factors including age of teachers, area of residence, and gender. The implications of the findings are discussed.

1. Introduction

India is a low-income developing country. It has a large population and limited resources resulting in inequitable distribution—especially when it comes to pediatric health care. Estimates suggest that as of 2016, only 10% of Indian children with disabilities were being accurately diagnosed, and even fewer were able to continuously access the appropriate interventions (Gururaj, Varghese, Benegal, Rao, Pathak & Singh, 2016). In the absence of institution-based programmes for individuals with disabilities in India, community-based rehabilitation (CBR) has flourished, and is an important cornerstone of the healthcare system. CBR can be defined as 'a strategy within general community development for the rehabilitation, equalization of opportunities and social inclusion of all people with disabilities' (Hunt, onnusamy, Goulet, Anthonypillai, Muthukaruppan & Bharathwaj, 2020).

Schools have emerged as key players in CBR programmes. India's Right to Education policy dictates that all children between 6 and 14 years of age are entitled to free primary education, which has resulted in a record number of enrollments in recent years (Chandrappa, 2014). Schools play an important role in identifying children at risk for various developmental, mental, emotional, or behavioural issues. Early identification of disability is essential in order to improve both the prognosis and the quality of life of at-risk children's lives (Lange & Thompson, 2006; Koegel, Koegel, Ashbaugh, & Bradshaw, 2014). The likelihood of experiencing negative life events such as difficulty learning, inability to stay in school, increased rates of unemployment, criminal activities and lower socioeconomic status is much higher among chil-

dren with disabilities (Rohwerder, 2015). Such risks jeopardize the academic performance, interpersonal development and future growth of children with disabilities, and can eventually result in their exclusion from society and workplace (Rohwerder, 2015). Early identification facilitates appropriate intervention which in turn can aid improve concentration, motivation, and achievement in the class (Chow, 2020). It also helps with socialization. Having adequate social skills and relationships in the classroom can help enhance the child's self confidence, sense of belonging, and foster a strong support system, all of which are strong protective factors against future risk (Chow, 2020; Koegel, Koegel, Ashbaugh, & Bradshaw, 2014). Behavioural issues such as acting out, or aggression can also be mitigated before they become causes of concern (Doncheva, 2018).

Since teachers spend large amounts of time working closely with children, they are often the first to notice a change in development or the beginning of social and academic difficulties in students (Soneson Howarth, Ford, Humphrey, Jones & Thompson Coon, 2020). Even without formal mental health training, teachers seem to be intuitively attune to the needs of their students. Mathews, Newlove-Delgado, Finning, Boyle, Hayes & Johnston (2020) found that while a teacher's concern for a child's wellbeing was moderately predictive of the presence of a mental health disorder, the lack of teacher concern was highly predictive of the absence of mental health issues (Mathews et al., 2020). Similarly, a study by Loades and Mastroyannopoulou (2010) found that teachers were able to recognize the presence of a mental health disorder and were able to rate its severity by simply reading short vignettes that describe certain behaviours typical of the age group. Such findings

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highlight the ability and importance of educators in screening for mental health issues or disabilities (Loades and Mastroyannopoulou, 2010).

The role of teachers in the identification of 'at risk' children is especially important in developing countries such as India, where most children do not have easy access to child health specialists (Coutinho & Saini, 2021; Gururaj et al., 2016). The intuitive abilities of teachers can be further capitalised upon by structured teacher training programmes. Various studies have found that even short term teacher training can greatly empower educators to make well-informed mental health decisions (Hussein & Vostanis, 2013; Naik Nithyananda, Chandrakanth, Virupaksha, Reshma & Basavaraj, 2015). Hussein and Vostanis' (2–13) pre-post study conducted in Pakistan found that a 2-day workshop (12 h in total) on common child mental health issues was enough to result in a statistically significant increase in the teacher's knowledge and awareness of the symptoms of mental health issues. Interestingly, the largest improvements were seen in the teacher's ability to devise appropriate behavior management strategies for the classroom (Hussein & Vostanis, 2013). Another similar study by Naik et al. (2015) evaluated the efficacy of a School Mental Health Programme (SMHP) providing psycho-education to teachers in Bangalore, India. The study concluded a significant increase in post assessment scores indicating an increase in knowledge and ability to manage child mental health in educational settings (Naik et al., 2015).

Appropriate teacher training empowers teachers to identify children 'at risk', and results in more children receiving preventive interventions (Guo, Wade & Keller, 2008). The cost efficacy of school-based mental health interventions, especially in low income countries, has also been greatly discussed (Hussein & Vostanis, 2013). However, a qualitative analysis of teachers' perceptions of their own efficacy in identifying mental health issues in children conducted by Rothi, Leavey and Best (2008), indicates that a majority of teachers feel inadequately prepared to manage these needs (Rothi et al., 2008). Although they believe that they can identify changes in behavior that might indicate 'risk', they are unsure regarding what constitutes a 'mental health problem', and when intervention might be required. Additionally, many teachers indicated that they do not feel comfortable using psychiatric language (Rothi et al., 2008). Another study by Loades and Mastroyannopoulou (2010) indicated that although teachers are intuitively aware of the needs of their pupils, they are much better at identifying children at risk for externalizing disorders (temper tantrums, conduct disorder, impulse control), as compared to those at risk for internalizing disorders (depression, anxiety). Similarly, teachers have been found to be better at identifying risk in male children (Loades & Mastroyannopoulou, 2010).

The use of objective rating scales and technology based systems have been suggested as a means of further empowering teachers, and overcoming the shortcomings of solely teacher-based referrals. Dowdy et al. (2015) found that, as compared to intuitive teacher nominations, universal screening methods were able to identify significantly more children who were at risk for developmental or behavioural difficulties (Dowdy et al., 2015). Going a step further, Diez-Canseco Toyama, Ipince, Perez-Leon, Cavero and Araya (2018) determined that app-based mental health screening tools can lead to a significant increase in accessibility to mental health services. Adequate training was also recognised as the primary facilitator of the improved identification. The researchers further suggested that such electronic screening tools can be used in a variety of contexts to make the identification process smoother and more accurate (Diez-Canseco et al., 2018).

The purpose of this paper is to evaluate a teacher training program that utilises an app-based screening tool to help empower teachers to correctly identify children at 'risk' and help them provide appropriate interventions. This is the second stage of a multi-step process. The process can be divided into 5 stages namely Screen, Learn, Act, Track, and Enable. The first stage 'screen' aimed to validate a web-based risk assessment tool to screen for children who are at risk of disability, abuse, or mental health issues (Coutinho & Saini, 2021). The second stage 'Learn'

is outlined in the current paper and seeks to provide comprehensive teacher training in order to equip educators in identifying children at risk in the classroom. The next stage 'Act' educates children-at-risk and their families about government schemes that may be beneficial to them. The goal is to remove any obstacles that might reduce accessibility to services. The fourth stage focuses on creating a progress tracking system which will enable vulnerable children to remain in school through prompt identification and support. The last stage 'Enable' is geared towards empowering all stakeholders to create a brighter future for at-risk children.

2. Methodology

2.1. Study design and sample

The study employed a pre-post research design. Participants were recruited using convenience sampling from 3 districts in Tamil Nadu, India that were representative of the urban, rural and semi-urban areas. The inclusion criteria were 1. Participants need to have at least two years of teaching experience 2. Participants need to be fluent in written and spoken Tamil 3. Participants need to be able to use mobile applications ('apps'). The participants were requested to register themselves using a google form. The sample consisted of 1061 teachers. No financial incentives were provided from participating in the study. The study was undertaken as a part of Sols ARC's intervention partnership with the Tamil Nadu state government. It was approved by the institution's ethics and review board.

2.2. Description of the application

A Mobile application called the 'Red Flag' which is designed to evaluate teacher knowledge regarding identification of children at risk in the classroom was used for the study. The app consists of 85 self-report items grouped into 7 risk areas, namely Attention Deficit Hyperactivity Disorder, Autism Spectrum Disorder, Abuse, Intellectual Deficits, Mental health challenges, specific learning disorders, and visual deficits. Each item is rated on a 5 point likert scale ('never', 'sometimes', 'Often', 'Very often', and 'always'). In order to protect confidentiality, the app encrypts any personally identifiable information, and this can only be accessed by the teachers using the application. The English version of the application has been found to have good reliability and validity (Coutinho & Saini, 2021). The English application was translated into Tamil by a professional translator. A third-party clinical researcher (with no experience in translation) conducted a back translation for the Tamil versions of the questionnaire.

2.3. Case validation

In total, 16 simulated case studies were used to assess disability identification during the pre and post assessment phases. Half the cases ($n = 8$) described risk for a single disability (SR1–8), while the other half described cases at risk for multiple disabilities (MR1–8). The cases were created by experts on the RedFlag team. The disabilities described in each case were defined as per their corresponding DSM V criteria. The cases were sent for review to 3 experts in the field with a minimum of 10 years experience, and modified as per their feedback. A final review was done by the experts before cases were used in the study.

The 16 case studies were divided into 8 sets with each set containing 3 cases. One of the case studies describing a single disability was common across all 8 sets to ensure there were no large variations in the responses of the teachers across the sets. The other two case studies indicated single and multiple disabilities respectively. Sets were randomly assigned, and teachers assessed the same set during both pre and post assessment.

2.4. Data collection and measurement

Pre Assessment was conducted using google forms. Participants were given three case studies (two with a single disability, and one with multiple disabilities), and were asked to identify the disability using their pre-existing knowledge. They were asked to select the appropriate disability from a list provided.

The participants were then asked to download the ‘RedFlag’ app, and were trained in how to navigate and use the same. Training was provided to upto 40 teachers at a time. In total 44 training batches were conducted. Training was imparted as an in-person half day workshop (10am to 1pm) between February and March 2021. Participants were guided by a Sols ARC trainer as to how to download the application. Registration, as well as the screening process and interpretation of the results were demonstrated to the participants. Next, the participants were asked to register themselves and experiment with the different features on the app. Support and guidance was provided by the Sols ARC trainer throughout the process. Once the participants expressed comfort with the app, the post-assessment phase was begun.

Post Assessment measurement was conducted using the ‘RedFlag’ app. Participants were given the same 3 case studies as the pre-assessment phase. Each case was accompanied with multiple statements organized by type of disability. Initially only half of the total questions for that disability were displayed. Only if the participants correctly chose at least 50% of the statements provided would a new form populated with the remaining questions appear. Participants were asked to rate each statement on a 5 point likert scale (‘never’, ‘sometimes’, ‘often’, ‘Very often’, and ‘always’). Each option on the likert scale had a self weighted score. The maximum possible score for each statement was 4. Each type of disability had between 8 and 12 statements, and a total score was assigned to the type of disability based on the number of statements under it. A cumulative score was calculated for each disability based on options endorsed by the participants for each statement.

The proportion of the cumulative score upon the total score was calculated, and was categorized into 4 groups to understand the severity of the risk of disability (0–20% - No risk, 20–30% - low risk, 30–50% - medium risk and more than 50% - High risk). Single disability cases that were correctly identified by the teachers were labelled as ‘correctly assessed’. For multiple disability cases, if participants correctly identified even one case study with any risk it was considered as ‘correctly assessed’.

2.5. Data analysis

Descriptive statistics were calculated for the sample. Pearson Chi-square test was used to compare correct assessment by various characteristics of the participants during pre and post separately. McNernan’s chi-square test was used to compare the changes in correct assessment during pre and post for various characteristics. Odds ratios and p-values with 95% CI were calculated.

3. Results

3.1. Demographic results

The study population consisted of 1061 teachers from Tamil Nadu. Among them, 76% belonged to rural areas, and 24% belonged to urban areas. In terms of age and gender, 55% of the participants were over 45 years of age, and 69.1% of the sample was female. From an academic point of view, 53.1% of the sample had received a postgraduate degree or higher. On average the participants had 17.8 years of teaching experience (SD 9.1). 68% of the sample reported having previously worked with special children, and 44.4% of them reported having received special training. Detailed demographic details can be found in Table 1.

Table 1 Demographic Details of the Participants.

		N	%
Age distribution	< 35	104	9.8
	35–40	211	19.9
	40–45	180	17.0
	46 to 50	259	24.4
	More than 50	297	28.0
	Missing	10	0.9
	Mean age	45.2	
	SD	7.27	
	Gender		
	Male	328	30.9
	Female	733	69.1
Education	Diploma / Graduate	493	46.5
	Post graduate and above	568	53.5
Total Experience (Years)	Upto 10	206	19.4
	10–15	219	20.6
	15–20	229	21.6
	20–25	242	22.8
	More than 25	165	15.6
	Average exp	17.8	
	SD	9.1	
	Worked with		
Special children	Yes	722	68.0
	No	329	31.0
	Missing	10	.9
Received Special training	Yes	471	44.4
	No	590	55.6
Grade	Single Grade	559	52.7
	Multi grade	469	44.2
	Not available	33	3.1

Table 2 Number of cases correctly identified during pre and post test.

Number of cases correctly identified	Pre-testn(%)	Post-testn(%)
0	246 (23.19%)	118 (11.12%)
1	364 (34.31%)	290 (27.33%)
2	315 (29.68%)	286 (26.96%)
3	136 (12.81%)	367 (34.59%)

3.2. Overall pre and post assessment of disability

Overall, 76.8% (n = 815) teachers were able to correctly identify at least one case of disability during pre-assessment. In contrast, 88.9% (n = 943) teachers were able to correctly identify at least one case of disability during the post assessment phase (Insert Table 2). The likelihood of correct identification increased 2.69 times when the red flag app was used as opposed to when it was not (OR= 2689, 95%, CI: 1.80–4.00).

3.3. Pre and post assessment as per case studies correctly identified

During pre-assessment, 23.19% (n = 246) of the teachers were unable to correctly identify any cases, 34.31% (n = 364) were able to correctly identify one case, 29.68% (n = 315) were able to correctly identify 2 cases, and 12.81% (n = 136) were able to correctly identify all three cases. In comparison, during post assessment, 11.12% (n = 118) of the sample was unable to correctly identify any cases, 27.33% (n = 290) of the sample was able to correctly identify 1 case, 26.96% (n = 286) were able to correctly identify 2 cases, and 34.59% (n = 367) were able to correctly identify all 3 cases.

Among the teachers who were unable to correctly identify any cases during pre-assessment (n = 246), 80% (n = 197) were able to correctly identify at least 1 case during post-assessment. Similarly, among the teachers who were able to correctly identify 1 case during pre-assessment (n = 364), 52.5% (n = 190) were able to correctly identify 2 or more cases during the post-assessment. Among the teachers who were able to correctly identify 2 cases during pre-assessment (n = 315),

46.98% ($n = 148$) were able to correctly identify all 3 cases during post assessment. Lastly, among the teachers who were able to correctly identify all 3 cases during pre-assessment ($n = 136$), 62.5% ($n = 85$) were able to also correctly identify all 3 cases during the post assessment. These results will be further analysed in the discussion.

3.4. Pre and post assessment comparison as per teacher characteristics

3.4.1. By area

Usage of the red flag app increased the odds of correct identification of risk 2.57 times among rural areas (OR = 2.57, 95%, CI: 1.647–4.015), and 3.23 times among urban areas (OR = 3.22, 95%, CI: 1.317–7.92).

3.4.2. By age

In terms of age, the odds of correct identification increased 1.75 times among teachers below 45 years of age (OR = 1.75, 95%, CI: 0.84–3.65), and 3.03 times among teachers above 45 years of age, with the use of the red flag app (OR = 3.03, 95%, CI: 1.828–5.041).

3.4.3. By gender

Male teachers were 3.83 times more likely to correctly identify disability using the app (OR = 3.83, 95%, CI: 1.976–7.42), while female teachers were 2.16 times more likely to make correct identifications using the red flag app (OR = 2.16, 95%, CI: 1.30–3.59).

3.4.4. By education

Usage of the red flag app increased the likelihood of correct identification of risk 3.21 times among teachers who held an undergraduate degree (OR = 3.21, 95%, CI: 1.85 - 5.58). On the other hand, the use of the app increased the likelihood of identification 2.16 times among teachers who held a postgraduate degree or higher (OR = 3.89, 95%, CI: 1.21 - 3.89).

3.4.5. By experience

There was a 2.97 times increase in identification of disability among teachers with less than 16 years of experience while using the red flag app (OR = 2.97, 95%, CI: 1.57 - 5.649). Similarly, usage of the app resulted in a 2.43 times increase in identification of disability among teachers with more than 16 years of experience (OR = 2.43, 95%, CI: 1.462- 5.649).

3.4.6. By previous work with special children

The odds of correct identification increased 2.50 times while using the app among teachers who had worked with special children before (OR = 2.50, 95%, CI:1.54 - 4.07). On the other hand, the odds of correct identification increased 3.12 times while using the app among teachers who did not have prior experience working with special children (OR = 3.12, 95%, CI: 1.55 - 6.27).

3.4.7. By prior special training

Use of the red flag app increased the likelihood of correct identification 2.87 times among teachers who had received special training (OR = 2.87, 95%, CI: 1.699 - 4.960), while it increased the likelihood of correct identification 2.38 times among teachers who had not previously received any special training (OR = 2.38, 95%, CI: 1.32 - 4.31).

3.4.8. By grade levels taught

Among teachers who taught a single grade level, usage of the app resulted in a 2 times increase in correct identification (OR = 2.00, 95%, CI: 1.142 - 3.518). Among teachers who taught multiple grades, usage of the app resulted in a 3.73 times increase in correct identification of disability (OR = 3.72, 95%, CI: 2.067 - 6.712).

4. Discussion

The present study seeks to explore whether the 'RedFlag App' improves teacher's ability to correctly identify students at risk for various developmental issues. With access to smart-phones increasing, mobile health tools (mHealth tools) have witnessed a surge in popularity especially in low resource areas. These tools are cost effective, easy to use, have wide applicability, and reduce the burden on primary healthcare providers (Lacey Dunsmuir, Kumbakumba, Ansermino, Larson & Lester, 2016). In terms of the current study, the findings indicate that using the RedFlag app more than doubles the likelihood of correctly identifying disability. The application automates a majority of the decision making, and reduces the likelihood of accidentally overlooking a symptom associated with a disability (Coutinho & Saini, 2021; Lacey et al., 2016). Posttest data indicates a 12% increase in the number of teachers who were able to correctly identify at least one disability after being trained in using the app.

Along with equipping new teachers, usage of the RedFlag app also improved the frequency of correct identification for a majority of the teachers. Among the teachers who were unable to correctly identify any cases during the pretest, 80% were able to identify at least one during the posttest. Similarly, from the teachers who correctly identified at least one case correctly during pretest, 52% were able to correctly identify two or more during the posttest. Similar improvements were noted for teachers who correctly identified two and three cases during the pre-test as well. Surprisingly, only 62.5% of the teachers who correctly identified all three cases during pre-test were able to replicate this occurrence during post-test. It is possible that participants were unable to understand some of the statements, or adopted a casual approach towards assessment due to overreliance on the application.

Various demographic factors also influenced the benefits accrued from the RedFlag app. Interestingly, the largest difference in the likelihood of correct identification using the redflag app was seen across the variable of age. Although a significant increase was noted for both teachers above and below 45 years of age, the likelihood was found to be 3.03 times more for the older group, and 1.75 times more for the younger group (below 45 years of age). One possible explanation could be the imbalance in teacher awareness and training regarding mental health concerns. Conversations regarding mental health have recently begun to garner traction in India, and it is likely that younger teachers have had improved recent access to information and training programmes about such issues. In comparison, older teachers might not have had the same instruction, and therefore were able to identify children at risk much better using the app.

In terms of geographical area, the results indicated that usage of the app increased the likelihood of correct identification among teachers in urban areas more than 3 times, while the increase in rural areas was found to be around 2.5 times. These findings suggest that all the teachers were significantly aided by the RedFlag app. The difference in the odds ratio for these two groups can be attributed in part to the urban-rural divide. The Annual Status of Education Report (ASER) published in 2018 found that there was still a large difference between schooling in urban and rural areas. Rural schools lack proper infrastructure, and have little to no emphasis on technical education and skill (ASER Centre, 2019). Although all the teachers included in the present study were thoroughly trained, it is possible that urban teacher's increased familiarity with technology and smart-phone based applications allowed them to derive greater benefit from the same.

However, along with education, India also has a great divide in healthcare facilities between urban and rural areas. As per the 2011 census, 75% of the nation's doctors are concentrated in urban areas, while nearly 75% of the country's population reside in rural areas (Chellaiyan & Taneja, 2019). Telemedicine- which can be defined as providing healthcare at a distance- has been posited as being the fastest

and cheapest way of bridging this gap (Bagchi, 2006). The findings of the present study support this notion, and indicate that the use of apps can significantly improve the process of identifying children at risk for health concerns in rural areas. However, it is important to note that tele-medicine can have different functions. In the context of the RedFlag app, the tool is only being used to identify children who could potentially be at-risk. They will then be referred to healthcare professionals who may make a formal diagnosis based on their clinical judgement.

On the whole, the results of the present study indicated that usage of the RedFlag app significantly increased the likelihood of correct identification of children at risk. The usage of apps for mental health screening and interventions has skyrocketed over the past few years (Bettina, Deighton & Edbrooke-Childs, 2021; Lacey et al., 2016). Apps that have been previously used with 'at risk' children have been well received by both students and teachers, and have been praised as being acceptable, usable, and helpful (Bettina et al., 2021).

The importance of early identification of children at risk has been well documented (Lange & Thompson, 2006; Koegel et al., 2014; Chow, 2020). Similarly, studies which examine the perspectives of educators have also found that most educators believe that risk identification programmes are a necessary aspect of schooling (Soneson et al., 2020). However, most teachers, especially in India, are overworked and overburdened (Kaur, 2013). Even those with special training might not always be able to correctly identify at-risk students in a timely manner (Singhal, 2009). The introduction of a psychometrically sound instrument such as the RedFlag App allows for the creation of a standardized screening procedure wherein each child can be uniformly but comprehensively assessed (Coutinho & Saini, 2021). Children who are deemed to be 'at-risk' can further be referred to a specialist and be provided with adequate support within the classroom.

4.1. Limitations

The study needs to be understood in the context of its limitations. Firstly, recruitment of participants was limited to three areas in Tamil Nadu, therefore the data collected might not be representative of all educators in India. Similarly, since the cases used in the present study were simulated, they might not be truly representative of actual children at risk for disabilities.

The pre-post study design is also prone to the response-shift bias (Drennan and Hyde, 2006). In the present study, the training program could have improved the teacher's understanding of the constructs being measured, which could have influenced their ability to identify children at risk irrespective of the RedFlag App. Practice effects might be another confounding variable. Teachers were given the same case set for both the pre and the post assessment phases and familiarity with the material could have influenced their performance.

5. Conclusion

The present study found that the RedFlag app significantly increased teacher's ability to identify children at risk for developmental disabilities. The app improved the performance of a majority of the teachers regardless of age, gender, area of residence, education level, and experience. The app holds immense potential for improving outcomes and bridging the gap between rehabilitation services and the children who require them.

Funding

This work was supported by Porticus Foundation; Maitri Foundation; and HT Parekh Foundation

Declaration of Competing Interest

The authors have no competing financial interests or personal relationships to declare.

Acknowledgments

The authors would like to thank Mr. Bharadwaj for his help in computing the statistics for the study.

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