Commentary

Colour coding-based client segmentation approach: A neglected yet powerful tool to tackle non communicable diseases in high burden and low resource setting countries- A primary care approach

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Abstract

Health systems in low- and middle-income countries like India continue to struggle with the overwhelming burden of noncommunicable diseases (NCDs) alongside the coexistence of multiple medical conditions. Such cases are challenging to diagnose and treat, especially in places where electronic health records are not readily available. In such contexts, using colour coding system for recording health conditions may ensure optimal documentation, effective patient-provider communication, adherence to treatment and follow up, quality of health services, and an overall improvement in health systems performance for NCDs. Colour coding is a common tool used in several service industries including public health programmes locally and globally. Despite such promising aspects, colour coding is not widely used for NCDs in health services organizations, which necessitates a translation of evidence from other sectors and the adoption of innovative and evidence-based approaches to promote the use of colour coding for better addressing NCD epidemic.

Keywords: Client segmentation, colour coding, non-communicable disease

Case Study -1 (Emergency room, Rural Hospital, Bihar, India)

A 50 years old unconscious patient brought to the emergency by the public at midnight. A young EMO and few interns were working in the night shift in a rural hospital. The EMO replied "check his airway, breathing and circulation, blood pressure, send blood samples for sugar, lipid profile and electrolytes, hurry up, this can be a case of hypoglycaemic coma." After starting emergency treatment, the patient died within 30 minutes, before any conclusive diagnosis was made (His blood pressure was normal at that time). The next morning, when the relatives and family came to take the body from the hospital, the relatives showed the previous issued health card, which mentioned that

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the patient was suffering from chronic hypertension, was under treatment and had a history of cerebral stroke.

Case Study-2 (General Medicine OPD, Chandigarh, India)

In a morning OPD in Chandigarh, a 60-year male was standing a long queue to visit his doctor like other patients. He was a known case of diabetes and he was holding a similar white coloured OPD card like others. Suddenly he felt uneasiness in his chest. He did not experience any pain. He thought that may be he was suffering from acidity, as usual, he took antacid from his bag and collapsed on the floor. The autopsy revealed that he had undergone a massive cardiac arrest following a silent myocardial infarction.

From the above case studies, it is evident that one thing is common that the patients were not identified/labelled as high-risk cases. This resulted in critical problems during emergency management. From epidemiological point of view, we know that risk communication is equally important as risk identification.[1-4] In the above 2 case studies, the cardiovascular risk had been identified by the previous treating physician. But there was no system (or attempt at record linkage; or continuity of care). It was not communicated properly to the patients, significant others or prospective treating physicians.

Asymptomatic high-risk chronic patients are difficult to identify by the common public. Sometimes, for the critical patients, precious time is lost because their previous records are not available/produced (and are considered unimportant).

In advanced countries, where the electronic health record systems are fully functional, it is just a matter of seconds where all patient details are available through a computer keyboard click.[5,6]

In countries like India, the use of technology in health care is limited, the culture and language are diverse, and healthcare resources are scarce.[7-10] Here, colour coding system for identifying/labelling the high-risk patients suffering from non-communicable diseases may be an alternative for quick identification/triage of these patients. This may not only save time but also it can save lives by prioritizing care of such patients in busy emergency OPDs in the hospitals. The same colour coding system is useful in community health where the high-risk patients are followed up by the peripheral health workers who have limited medical knowledge and scarce healthcare equipment.

Colour coding is process of displaying crucial information by using different colours for providing prompt help and decision making.[9] First colour coding system was used in the military operations, to delineate natives from enemies, later it is used by different sectors like the electronics industry, navigation sector etc., In the health care, it is incorporated in diagnostic as well as therapeutic purposes. [Table 1]. Whether it is in the military or medicine, the main advantages of using colour coding include ensuring better delineation, maintaining high quality, proper sorting of items of interest. Ultimately it helps in error prevention, warranting health promotion and enhancing patient safety, directly or indirectly.[11]

Table 1: Some existing uses of colour coding in health sector

Programmes/ Medical conditions	Use
Malnutrition	Shakir's colour coded tape
IMNCI	Colour coded Integrated Management of Neonatal and Childhood Illness card
Disaster	Triage using colour code
Bio Medical Waste Management	Colour coded bins
National AIDS Control Program	Colour coded Sexually Transmitted Infections/Reproductive Tract Infections kits
National Tuberculosis Elimination Program	Colour coded anti TB medication box
National Immunization programme	Colour coded Vaccine Vial Monitors
Menstrual health	Colour coded beads

It is well known fact that in poor countries and in low-resource situations, colour coding plays a vital role to promote quality health care services by the peripheral health workers.[9] Besides helping in the diagnosis of health conditions, it also serves as a basis to start a proper treatment in public healthcare. This in turn augments the health system to improve the existing poor health indicators of the whole.[11] Another advantage of colour coding is to minimize man made errors like common diagnostic or therapeutic errors.[12,13]

There are many examples of successful use of colour coding systems in public health. The World Health Organization (WHO) has recommended for the inclusion of colour coded growth charts in identifying malnourished under five children and categorizing the same.[13] These colour coded growth charts not only useful to the physicians but also to the mothers (irrespective of their literacy status) in health problem identification, intervention, and follow-up (nutritional rehabilitation program for the child).[13] Additionally, a simple tool named-Shakir's tricoloured tape is very useful to screen (by measuring the mid-upper arm circumference) large population of under-five children for malnutrition with minimal cost, training and high precision.[14]

Colour coding system is also used for appropriate management of common childhood disorders by syndromic approach (acute gastroenteritis, acute respiratory tract infections, *etc.*), under the umbrella of Integrated Management of Neonatal and Childhood Illness program (IMNCI).[15]

In disaster management, the triage method is used.[10] Triage is nothing but a similar colour coded technique, where the patients are quickly differentiated by any health care personnel based

on the "severity of their injuries" and the "likelihood of their survival" with quick medical/surgical interventions.[10] In disasters four colour codes are used, a) red tag (for critical patients need emergency intervention), yellow tag (it is used for critical to minor categories, who require urgent intervention), green tag (it is for ambulatory patients who require minor intervention), and black tag (it refers to dead persons).[16] Triage enables health and allied professionals to take the best possible course of action for the disaster affected persons where resources are scarce.[16]

Cycle-beads (thread of four colour-coded beads) are often used for DAY-COUNT;to track each day of menstrual cycle and to identify the fertile days.[17] Red colour beads – indicates the first day of menstrual cycle; blue/brown colour beads – represent the time period when women is not likely to get pregnant despite of unprotected sex; white colour bead –represents probable days on which a women can get pregnant; and dark brown colour beads-represents menstrual cycle is shorter in duration i.e., < 26 days.[17] It is considered as a useful tool for women having low literacy. Advantages of the colour bead technique are -it can be used without medical supervision, side effects (like in conventional oral contraceptive pills) and more importantly it helps women empowerment in easy and transparent way.[17]

Colour coded kits are supplied under the National AIDS Control Program (NACO) for the management of sexually/reproductive tract infections (STI/RTI).[18] It allows syndromic management of STI/RTIs, especially lower level health facility like in primary health care centres where resources are limited.[18] Although the final diagnosis for these conditions is made by the trained medical officer in peripheral health centre.[18]

The principles of patient-wise colour coded box have also been employed in the treatment of tuberculosis under the National Tuberculosis Elimination Program (NTEP) and for the National Leprosy Elimination Programme (NLEP) in India.[19]

These colour-coded treatment regimens empowers community health worker as well as patients themselves to manage their health conditions (after the confirmation of diagnosis of the disease by experts).[19]

As per BMW 2016 rules colour coding is used in health facilities for proper biomedical waste management.[19] Under this rule, four colour-coded bags (yellow, blue, red, black) are used to allow safe disposal of the biomedical waste.[19] The principles of colour-coding are also used in health sector extensively.

It is evident from the above discussion that colour-coded approach is used in multiple ways, in multiple settings, for multiple diseases. To our knowledge, little focus has been given for non-communicable diseases. In the community or the hospital level, healthcare providers diagnose many hypertension, diabetes cases, and perform multiple tests like blood sugar, lipid profile, HbA1c etc., but little efforts are adopted to risk profiling during these key healthcare processes. From the above 2 cases it is evident we become puzzled whenever patients collapse in front of us and we usually waste our "Golden Hour" for the treatment in searching patients' medical details.

The above problem can be solved by risk profiling of chronic patients say hypertensive patients by colour coded OPD/Health cards using standard risk prediction charts or simply we can develop colour coding as per our convenience. This can be done in a community-oriented colour coded client segmentation approach based integrated comprehensive care program [Table 2]. One step ahead we can write interpretations and recommendations/instructions on this colour coded health card in an easy language for better understanding of the patients (Like Mother Child Protection card).

Advantages

This simple yet powerful tool has multiple benefits-

1. It will help patient segmentation according to risk profiles (carry in pocket colour coded health card)
2. It will serve as a community triage, specially at primary care settings.
3. It will be easy to identify high-risk patients in a crowded OPDs and it can be very helpful to the patients, doctors, health staffs and most importantly for the bystanders in case of any medical emergency.
4. It can serve to create a subjective norm for such an approach by applying social pressure.

Limitations

However, the colour-coded approach has some limitations as an example we have limited colours for coding against abundant pharmacological products available; providers or patients with colour-blindness may not understand regular colour codes; sometimes, the colour coding may be inaccurate; initial cost of making colour coded health cards, training required for health professionals; and connotation of certain colours with specific meaning like red for warning, black or white for death, and therefore it should be used judiciously to avoid confusion. These challenges should be carefully evaluated and addressed through

Table 2: Proposed colour coding based comprehensive care program for hypertension control in a community

Colour coding	Interpretation	Recommendations
	Normal blood pressure	Carry out physical activity daily
	Borderline	Reduction in dietary salt and increase in physical activity
	Newly diagnosed	Regular Check-up is needed, lifestyle modification
	Already diagnosed	Strict adherence to the medication; maintain dietary modifications and follow routine exercise/walk
	Complications due to hypertension	Need rehabilitation and routine follow up

evidence-based interventions in respective contexts minimizing the hazards and maximizing health outcomes.

Conclusion and Recommendation

We conclude that, colour coding system in chronic disease has tremendous potential to ensure health service delivery of good quality, especially in primary care settings and where disease burden is high from chronic diseases. Universal implementation of a standardized colour-coding approach can benefit patients and healthcare professionals both in a sustainable way.

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Conflicts of interest

There are no conflicts of interest.

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