



# Rethinking or Affirming the “Affordability” Debate on the Efficiency of Urban Public Transport Usage: Case of Kumasi, Ghana

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Received: 9 August 2020 / Accepted: 1 July 2021 / Published online: 9 July 2021  
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## Abstract

This paper sought to contribute towards rethinking or affirming the affordability debate on the efficiency of intra-city public transport discourse in Africa. Using the case study approach, primary data was obtained from 400 passengers and nine officials of relevant institutions responsible for managing and regularising the informal public transport service in the city to assess the efficiency of intra city public transport in Kumasi based on nine indicators. Findings of the paper showed that the availability of public transport service largely influenced its patronage, contrary to the ‘popular’ assertion of affordability as the major determining factor. A multiple-linear regression analysis showed a statistically significant and positive relationship between the predictor (efficiency indicators) and dependent (use of public transport service) variables. Nonetheless, there exist inefficiencies in comfortability, vehicular conditions, affordability and travel duration. The transport institutions were unable to fully improve upon efficiency of services due to weak implementation of regulations, poor coordination among transportation agencies and inadequate transport infrastructure. This paper calls for conscious efforts to evaluate the service from its planning, to delivery and management as well as incorporate efficient and good quality indicators in the regularisation and operation of transport services.

**Keywords** Availability · Efficiency · Intra city transport · Kumasi · Public transport · Quality of service

## Introduction

The socioeconomic development and growth of cities rely on efficient public transport systems [17, 60]. Transport provides means which enable individuals to access businesses, education, employment and social activities [37, 44, 45, 47]. In developing countries, daily transport routes are mostly toward the Central Business District (CBD), which serves as

the economic hub of cities and residence for a host of people especially, low-income earners [15]. The CBDs of most cities across the globe have thus become areas of intense traffic congestion with several safety implications. Unfortunately, most users of public transport in many African cities do not own personal vehicles, hence, rely largely on public transport [17, 38].

The rapid population increase in many African countries has been associated with urban sprawl, urbanisation, peri-urbanisation, as well as the desire to increase income by engaging in economic and industrial activities. These have consequently substantially influenced the number of motorised trips [13, 38, 46] and thus led to the high demand for public transport services. The increasing imbalance between demand and supply of transport service has resulted in congested central areas, poor level of services from public transport operators, limited high-occupancy vehicles for transit, increases in private car use, environmental pollution and mix traffic with safety implications [38]. Generally, cities in both developed and developing countries are increasing automobile transport usage, though not sustainable in the long run [40]. Inasmuch as public transport operates within

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numerous challenges, it remains one of the most affordable, efficient and effective means of transport in ensuring sustainable transport systems and services for all.

Public transport systems, particularly those in developing countries, are largely informal and have relied primarily on minibuses, taxis, motorcycles and vans [17, 46, 47] operated by individuals within transport unions. Compared to formal public transport services, the informal service vehicles are more accessible, faster and often cheaper [28, 32, 35]. As a result of their importance in addressing mobility issues in many cities, several governments in Africa, including Ghana, have sought to improve upon their activities. Irrespective of being formal or informal, there have been several concerns about their efficiency (in terms of comfort, cost, safety, and reliability) and user's preference for such public transport services [35, 42, 60]. In spite of the concerns raised, it appears that interventions to improve upon efficiency have largely been informed by practices of the developed world, which is dominated by a formal sector, compared to that of the African region where the sector is largely informal. There exists a plethora of studies on the efficiency of public transport. Some have shown that public transport is highly patronised due to several factors for which affordability is much considered. Other studies (e.g., [9, 37]) assessed the quality of public transport based on spatial analysis. Within the sub-Sahara African region, Basorum and Rotowa [9] investigated the public transport operations in Lagos Island a sub-region of Lagos State in terms of the level of performance using efficiency indicators such as affordability, availability, safety, and convenience from the perspective of passengers. This analysis of efficiency was viewed from the passengers' perspective of the transport service, and also identified transport problems that hinder the operations of public transport in Lagos which is similar to public transport challenges in developing countries as discussed. It was also revealed that people in Lagos use public transport due to affordability. Another study, conducted to evaluate public transit systems in Abuja, hypothesised that people's opinion about the quality of service is largely based on affordability, which corroborates the assertion made by other researchers such as Basorum and Rotowa [9], Cervero [12] that affordability is often overemphasised in assessing the efficiency of public transport service in many developing countries. In the African context, studies have largely focussed on integrating the formal and informal public transport sector, with the assumption that achieving this integration would improve efficiency and mobility (see [19, 43]).

This paper, taking cognizance of the increasing numbers of public transport operators in the informal sector argues that achieving this integration although feasible, remains a daunting task on many governments of the developing world. Hence, the first step, among others, is to understand the level of operation and perspectives of users on the efficiency of

public transport services to guide future policies in addressing the numerous urban transport challenges. Therefore, providing efficient public transport is seen as the best strategy to promote effective mobility, socioeconomic growth as well as environment-friendly travel within cities. It is within the foregoing context that this paper examines the efficiency of intra-city public transport services in Kumasi, Ghana's fastest growing city, in order to achieve the intended aim of promoting accessibility.

## Literature Review: Public Transport Service in Sub-Saharan Africa

Modes of transport in developing countries are characterised by rail or road because they are affordable, have large demand and requires relatively low technology and skills to operate [9]. These transport services are mostly provided by the informal (or private) sector due to the failures of governments to ensure access to efficient transport for all [17, 60]. On this, Cervero [12] indicates that in the case of the poorest countries, governments largely hand over the provision of collective-ride mobility to informal operators. In India for instance, the federal government has partnered the private sector to ensure a holistic approach in service provision by opening the public bus sector to private companies.

Scholarly debates on affordability and efficiency of urban public transport in developing countries have been widely discussed. For instance, Motta et al. [36] report that the use of public transport in Brazil is declining at a fairly constant rate and being replaced by individual transport operators due to efficiency issues, including affordability of urban public transport. Again, others (see [10, 40, 51]) indicate that in Latin America, Africa and Asia, efficiency of urban public transport systems suffer from issues, which vary from one country to another based on the nature and extent of transport problems. These problems encompass low income, incompatibility between urban structure and increased motorization, limited regulatory/institutional effectiveness, overcrowded, uncomfortable, undependable, slow, extremely high levels of transport-related pollution, noise and other environmental impacts, especially in large cities, among others [18, 36].

Considering the increasing population in urban centres coupled with the absence of adequate policies, many cities of the developing world such as Bangkok (Thailand), Kuala Lumpur (Malaysia) and Delhi (India) are noted to be face challenges in providing efficient transport services [39, 40, 57]. This is argued to disturb patronage of public transport service and reduce accessibility to employment and urban facilities, particularly by the poor [7, 56]. The decline in density due to sprawl raises price accessing public transport services and also increase the travel time and distance to

facilities [28], as reported in Mexico by the World Bank [58] that 20% of workers spend more than 3 h in travelling to and from work each day, and 10% spend more than 5 h. This has implications on the efficiency of public transport services, where the sector is largely informal.

Furthermore, according to Starkey and Hine [52], bus transport is usually the cheapest mode of travel aside walking or cycling. In India for instance, a cycle rickshaw was 6 times more expensive per passenger-km than a bus while an auto-rickshaw was 15 times more expensive. However, rickshaws rendered special services, going ‘point-to-point’ and as a result, were mainly used by the ‘non-poor’ [26]. Nevertheless, the poor, according to Zhong et al. [61] will use rickshaws, paratransit and taxis in emergencies and non-routine situations when they have no other choice. It is evident that affordability of public transport is a major issue particularly for the poor and influence patronage of transport services. Those who have to use it may spend a high percentage of their income on such services. The idea that a maximum of 10% of income should be spent on public transport fares should become a ‘standard’ has been criticised by Gwilliam [24] and Carruthers and Mitric [11] who stated that households have array of expenditures to meet, hence, affordability of transport must be based on a household’s budget and costs of meeting other needs and services. Again, there are substitutions and trade-offs (for example between rents and transport cost) that households will consider in their choice of location and mode of transport, including whether to walk or not. Generally, many countries in the developing world lack the financial resources, appropriate government structures to implement effective and efficient mobility services at affordable prices that meet the expectations of citizens [59].

The above-mentioned situation is different in the developed world, especially part of Europe (for instance: Belgium, Croatia, France, Greece, Italy, Germany, United Kingdom), although the use of public transport is much popular, efficient and sustainable. For instance, New York City is popular for its low ownership of private automobiles and has the highest rate of public transport use in the USA [27]. It is reported that about 75% of residents depend on public transport for their mobility [40]. The nature of public transport is such that passengers’ comfortability and satisfaction are key in service provision which have resulted in authorities instituting standard measures—proper scheduling, well-maintained and comfortable large buses, the use of bus pass payment, good attitude of bus conductors—to make the services attractive [4]. Further, there are regulations that restrict auto mobility access into the CBD by banning private vehicles from accessing the core areas of the city to prevent unnecessary traffic and congestion caused by the use of private and low occupancy vehicles.

Orthodoxly, planning inclines to evaluate transport efficiency based on mobility, i.e., equating faster travel as being

efficient. However, assessing the quality of transport service has become a challenge due to unclear data and the lack of interest by policy-makers to holistically explore the sector to make informed decisions to ensure effective transport service delivery. According to Yeboah and Asibey [60], data concerning quality and performance assessment of transport service is unclear and generic. Though there are no specific measures in assessing the quality of a transport service, an emerging paradigm focuses on efficiency based on accessibility which gives different deductions and ways to improve the service [48, 49]. Hence, the most used criteria for assessing the efficiency of public transport include affordability, availability, safety, convenience, trip duration, working environment, information, and other subjective ones deemed appropriate, which largely formed the basis of this paper.

Ghana’s public transport system, similar to many others within the global south, has road as the dominant mode of travel which is used by all classes of people [43]. The public transport sector is primarily dominated by privately-owned minibuses (known as ‘trotro’ services) [41]. The emergence and growth in ‘trotro’ services in many Ghanaian cities was because of the failure of government’s public transport system to provide frequent, comfortable intra-urban and safe services due to rising financial losses, mismanagement and stiff competition from the private sector [1, 3]. The sector is argued to provide the major means of intra-city travel in the country, especially in the urban areas where about 95% of the service provided is by the informal sector [60]. Ghana’s public transport sector is also a ‘free-ride market’, characterised by free entry and exit, with minimal restrictions, despite the establishment of institutions such as the Ghana Private Road Transport Union (GPRTU) and Progressive Transport Owners’ Association (PROTOA) to manage and regularise the informal public transport operations. However, there seems to be no strategic mechanisms in ensuring efficient service provision and auto-mobility in city centres. This has resulted in the increased number of ‘trotro’ and taxis whose carrying capacities are 15 passengers and five passengers, respectively, causing pollution, traffic congestion, and unnecessary delays in accessing the CBDs [2, 47]. These challenges among others, have again contributed to the low quality of public transport service making it unattractive to the high-class groups. Nonetheless, the relatively low-class population (who appear to dominate the country’s populace) appear to have limited options than to patronise these services, consequently adding to the transport challenges posed by the traffic congestion and pollution within the city.

This paper, based on the above discussion, assesses the efficiency of intra—city public transport service delivery in Kumasi from the perspectives of users and relevant institutions (specifically, GPRTU, PROTOA and HERITAGE). In this research, efficiency of the service was assessed based on affordability, availability, safety, comfortability, information,

customer care, the condition of the vehicle, working environment and trip duration.

### Research Approach

The research was conducted in Kumasi, Ghana’s second largest but fastest growing city [60] with a population of 2,035,064 (Ghana Statistical Service [GSS], 2012). Kumasi has an annual growth rate of 5.7% which exceeds the national growth rate of 2.5% [21]. Kumasi has ten sub-metros with a total land area of 214.3 km<sup>2</sup> and serves as an important transport and commercial hub for both domestic and international traffic. The city’s role in transportation, commerce, education and administration attracts migrants from various parts of Ghana and beyond [14] with 53.7% of the population being migrants mostly from the northern part of the country. Areas such as Adum, Tech-Junction, Abrepo-Junction and Kejetia within the city were selected to assess the efficiency of intra-city public transport services to enhance accessibility. (Fig. 1). The selection of the study areas was done due to (i) the dominant use of public transport by urban inhabitants, (ii) proximity to the CBD, (iii) major points and frequent trips to the city centre from these points, and (iv) the geographical convenience as indicated in literature.

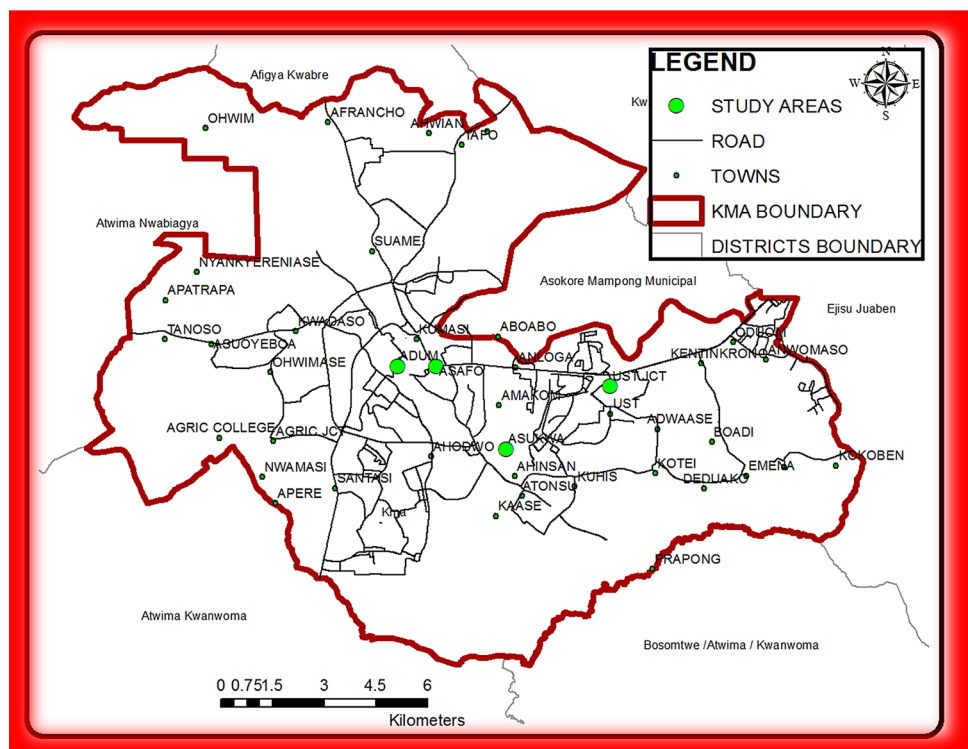
The descriptive case study was adopted for this paper to examine the efficiency of intra-city public transport based on passengers’ perspective about the service through the

administration of questionnaires and observations. Based on a similar approach adopted by Basorum and Rotowa [9] and Poku-Boansi [42], the non-probability sampling techniques (convenience sampling for passengers who were interviewed and purposive sampling for institutions interviewed) were employed. The units of inquiry and analysis consisted of users of public intra-city transport services (trotro) within the four selected neighbourhoods to access diverse services. Due to the absence of a sampling frame (which could have facilitated the adoption of a probability sampling technique), the convenience non-probability sampling method (based on participant’s availability and willingness) was employed to interview a total of 400 (100 each at the study points) participants, who were mainly passengers.

Specifically, passengers at various ‘trotro’ terminals within the selected neighbourhoods were interviewed conveniently at the respective study locations. Approximately 100 passengers each were interviewed at Abrepo Junction and Tech Junction, respectively, during the morning peak hours (6:30–9:30 am) when there is high demand for public transport to assess their economic activities within the CBD. Similarly, 100 passengers each at Kejetia and Adum were also interviewed during the evening peak (4–7 pm) when returning home after their economic activities. The vehicular-mix focussed on were mini-vans to medium buses “trotro” which is popularly used for intra-city transport within the city.

Institutions such as GPRTU, PROTOA and HERITAGE (transport unions or associations) were purposively

Fig. 1 Selected areas within Kumasi for the Study



engaged in expert interviews due to their direct responsibilities in ensuring efficient delivery and management of public transport. Three officials each were interviewed from these institutions, comprising, the Head, Assistant and any other official with relevant knowledge on the subject. A total of nine officials were thus interviewed. This sample size, although may be a limitation was deemed adequate for this type of study given the data difficulties, lack of reliable sampling frame, and the respondents' extensive experience, interest and understanding of public transport service delivery issues. Also based on first-hand knowledge, expert judgement and in-depth information they can provide about the research phenomenon, data on their respective roles in ensuring efficient service delivery, strategies adopted in the regularisation and management of the public transport, challenges and way forward in ensuring efficient service to passengers among others were gathered. This was done to get a holistic idea of the service provision with regard to the institutional role of ensuring efficient service delivery as informed by literature. The data were collected in 2017 but considering that various changes might have occurred over the years, a confirmatory survey was undertaken in October 2020 to interview executives of the relevant transport unions, and 15 conveniently sampled informal transport operators to better undertake the extent of changes in the types of services rendered, the charges on using transport modes, travel time, waiting times, and the number of vehicles, among others.

The efficiency of public transport service was assessed based on nine indicators, namely, affordability, availability, comfortability, safety, condition of vehicles, working environment, information, customer care, and trip duration (i.e. waiting time and travel time) and on a three-point likert scale. Hence, participants were asked to assess the efficiency of existing public transport services based on the nine indicators using the assigned three-point scale and give explanations for options given. A list of variables to assess the efficiency of a transport service was first generated from the review of relevant literature. It was observed that studies use any or some of the aforementioned variables to assess efficiency of a transport service (and not all in a single study) to achieve an intended purpose. This study, however, sought to have a comprehensive and better understanding of passengers' perception on public transport service efficiency by adopting all the above-mentioned parameters in a single study. This study acknowledges that although there could be more to the above, these parameters are deemed extensive enough to achieve the aim of this paper.

The availability of the service was measured using proxies such as location and number of bus stops, the characteristics of the route of the bus line (in terms of coverage) and nature of the service (for instance service

frequency, span of service, need for transfers) rendered. The affordability criterion was measured based on the overall monetary cost of using a public transport between an origin and a destination. Trip duration was however examined based on the average waiting time for a public transport and the travel time between an origin and a destination. Whereas the physical conditions of vehicles were assessed based on the interior and exterior of vehicles, the work environment was measured based on the conditions of bus terminals in providing a conducive environment (e.g., sanitation, noise, air pollution, and others) for users.

The safety of the service was measured based on respondent's perception on the likely occurrence of physical and verbal assault (such as fights, robbery, murder, insults), and injuries (specifically cuts) from the condition of vehicles. The comfort of the public transport service/vehicle was examined based on the interior aspects of the vehicle (trotro) such as seats, leg rooms, and vehicle-interior environment, among others noted to give basic comfort to users. Lastly, information and customer care indicators were measured based on the level of treatment passengers receive from operators before and during the journey such as courtesy, politeness, good manners and interaction between passengers and operators especially on immediate stops and payment arrangements.

To understand the extent of influence of public transport service's efficiency indicators (affordability, availability, comfortability, safety, condition of vehicles, working environment, information, customer care, and trip duration) as the predictor variables on patronage or frequency of use of the service (dependent variable), a multiple-linear regression model was undertaken; where the linear correlation coefficient ( $R$ ) and the coefficient of determination ( $R^2$ ) were used to provide further explanation of the results. The model applied was:

$$\dots y = k_0 + k_1 \times 1 + k_2 \times 2 + k_3 \times 3 + k_4 \times 4 + k_5 \times 5 + k_6 \times 6 + k_7 \times 7 + \dots + \text{where :}$$

$y$ —patronage or frequency of use of the service (dependent variable);  $k$ —Constant;  $\times 1$ —affordability (independent variable);  $\times 2$ —availability (independent variable);  $\times 3$ —comfortability (independent variable);  $\times 4$ —condition of vehicles (independent variable);  $\times 5$ —working environment (independent variable);  $\times 6$ —information (independent variable); and  $\times 7$ —trip duration (independent variable). The linear correlation coefficient, measured the strength and the direction of a linear relationship between two variables. This was accepted and deemed significant at  $p \leq 0.05$ . The qualitative analysis was essentially description and explanation of transport efficiency and variables of interest. Themes, codes and categories based on the interview transcripts were developed.

## Results and Discussion

### Frequency of Use, Trip Purpose and Reasons for Transport Patronage

Approximately 44% of the passengers interviewed used public transport services on a daily basis for various trip purposes, specifically, workplaces, schools and homes. About 34% used the services on a weekly basis, 9% twice or thrice a week and on a monthly basis, while 14% used the service occasionally for social purposes such as family gatherings, weddings, church and funerals (Table 1). This confirms the findings of Poku-Boansi [42] and Yeboah and Asibey [60] who stated that public transport remains the major means of mobility within Kumasi.

Of the number of participants interviewed, while 32 out of 87 daily users (37%) of public transport did so due to reasons of the availability of the service, 24 respondents (28%) used the service due to affordability, 16 (18%) based on the safety of the service and 15 (17%) based on the convenience of the services rendered by public transport operators (Table 2). Generally, it was observed that public transport services were patronised by passengers within the city due to service availability (32%), followed by affordability (31%), safety (21%) and convenience (17%). The findings on the dominant reason for patronising public transport services

**Table 1** Frequency of use and trip purpose (n=400) Source: Field Survey, March 2017

| Trip purpose      | Frequency of use |        |              |        | Total |
|-------------------|------------------|--------|--------------|--------|-------|
|                   | Daily            | Weekly | Occasionally | Others |       |
| Work              | 64               | 50     | 0            | 20     | 134   |
| School            | 10               | 4      | 0            | 0      | 14    |
| Access a facility | 40               | 44     | 30           | 4      | 118   |
| Home              | 46               | 28     | 20           | 8      | 102   |
| Others            | 14               | 10     | 4            | 4      | 32    |
| Total             | 174              | 136    | 54           | 36     | 400   |
| Percentages (%)   | 43.5             | 34     | 13.5         | 9      | 100   |

**Table 2** Frequent of use and dominant reasons for transport patronage (n = 400) Source: Field Survey, March 2017

| Frequency of use | Major reasons for using public transport |      |              |     |             |     |        |      | Total |      |
|------------------|--|------|--------------|-----|-------------|-----|--------|------|-------|------|
|                  | Affordability                            |      | Availability |     | Convenience |     | Safety |      | Freq  | %    |
|                  | Freq                                     | %    | Freq         | %   | Freq        | %   | Freq   | %    |       |      |
| Daily            | 48                                       | 12   | 64           | 16  | 30          | 7.5 | 32     | 8    | 174   | 43.5 |
| Weekly           | 30                                       | 7.5  | 40           | 10  | 24          | 6   | 42     | 10.5 | 136   | 34   |
| Occasionally     | 28                                       | 7    | 18           | 4.5 | 4           | 1   | 4      | 1    | 54    | 13.5 |
| Others           | 16                                       | 4    | 6            | 1.5 | 10          | 2.5 | 4      | 1    | 36    | 9    |
| Total            | 122                                      | 30.5 | 128          | 32  | 68          | 17  | 82     | 20.5 | 400   | 100  |

appear to be at variance with other studies (e.g., [9] which reported affordability as the major factor influencing users' patronage of public transport in developing countries.

### Efficiency of Public Transport in Kumasi: Perspective of Transport Users

The efficiency of transport service has become an important indicator in transportation planning practice and in academic circles in recent decades. The need to ensure an efficient public transport service is increasingly becoming an important consideration by public transport users due to long waiting times, late arrival at destinations and long delays at bus stops for vehicles. Premised on the foregoing, the efficiency of public transport in Kumasi was examined from the perspectives of passengers, along the lines of affordability, availability, comfortability, safety, condition of vehicles, working environment, information, customer care, and trip duration (waiting-time and travelling time) as earlier mentioned.

### Service Availability and Affordability as Service Efficiency Indicators

The attribute relating to availability indicator was measured by proxies such as location of bus stops, number of bus stops, characteristics of the route of the bus line (in terms of coverage) and nature of the service (for instance service frequency, span of service, need for transfers). Data gathered from the passengers showed that approximately 63% of them stated that the 'availability' of service was good, while 28% and 9% indicated that the service was fair and poor, respectively (Table 3).

*“There is almost always trotro available here to the CBD on any day, compared to taxis”. [Interview with a passenger at Abrepo-Junction]*

*“There is no time, even after 9pm, you do not find trotro going to the CBD. It is always available which makes it reliable and easy to move about” [A respondent at Adum]*

**Table 3** Percentage breakdown indicators under Parameter Scale Source: Field Survey, March 2017

| Efficiency indicator | Parameter scale |      |      | Total |
|----------------------|-----------------|------|------|-------|
|                      | Good            | Fair | Poor |       |
| Availability         | 63.1            | 27.5 | 9.4  | 100   |
| Affordability        | 48.6            | 36.5 | 14.9 | 100   |
| Condition of vehicle | 16.7            | 61.8 | 21.5 | 100   |
| Working environment  | 13.1            | 30.1 | 56.9 | 100   |
| Safety               | 57.7            | 27.5 | 14.8 | 100   |
| Comfortability       | 31.4            | 11.8 | 56.9 | 100   |
| Information          | 39.6            | 34.1 | 26.4 | 100   |
| Customer care        | 20.6            | 18.7 | 60.6 | 100   |

This was further buttressed by the officials of GPRTU that the union has instituted and mandated their members to comply with directives in ensuring that they position themselves at the appropriate bus stops provided by city authorities. This, they deemed was relevant in making transport services always available to passengers to their various destinations. This assertion was further confirmed by an official of PROTOA who remarked that:

*“PROTOA does not provide bus stops. It is up to relevant city authorities and those who design roads to do that. We however make sure that our members (drivers) are always present at the approved bus stops to render quality service to passengers. Where there are no bus stops, we consult city authorities to make use of available and appropriate spaces to render public transport services to passengers within the city”.*

On service affordability, approximately 49% of the respondents rated service affordability as good, 37% as fair and 15% as poor. This confirms studies which state that public transport is the most affordable means of road transport [43, 54]. Further, linear regression analysis between affordability (specifically, cost) and service usage showed a strong inverse relationship with a correlation coefficient (*R*) of  $-0.83$  and coefficient of determination of 0.689 (68.9%) implying that for every kilometre increase in the cost of transport, there will be reduction in service usage by 69% (Table 4). Passengers, from the above finding, could be said to be very sensitive to price changes in transport cost, which corroborates the assertion of Van Lierop et al. [54]. However, considering that 63% of the passengers rated availability of the service as good and it being the dominant mode of travel, it could be deduced that they would have limited and even no alternatives to travelling, should there be a continuous increase in the cost of public transport services.

This study has revealed availability as the main factor influencing the patronage of public transport services, which

**Table 4** Multiple-linear regression analysis of efficiency indicators and use of public transport Source: Field Survey, March 2017

| Efficiency indicators | Standardised coefficients |                | Significant coefficient (Sig) |
|-----------------------|---------------------------|----------------|-------------------------------|
|                       | Beta index                | Standard error |                               |
| Affordability         | $-0.421$                  | 0.155          | 0.006                         |
| Availability          | 0.275                     | 0.170          | 0.000                         |
| Safety                | 0.166                     | 0.182          | 0.045                         |
| Condition of vehicle  | 0.068                     | 0.180          | 0.001                         |
| Comfortability        | 0.064                     | 0.162          | 0.000                         |
| Information           | 0.030                     | 0.163          | 0.001                         |
| Working environment   | 0.021                     | 0.169          | 0.010                         |
| Customer Care         | 0.127                     | 0.178          | 0.003                         |
| Trip Duration         | $-0.178$                  | 0.128          | 0.000                         |

is at variance with other studies which concluded that affordability largely influenced passengers’ use of public transport [12, 37, 54]. In spite of the greater majority of the passengers indicating that the availability of public transport in the city is good, some passengers resort to altering their travel behaviour during periods where public transport services are unreliable. The findings indicate that about 34% of the passengers have employed alternative strategies such as leaving their homes early, walking to segments of routes where there are no bus terminals and reducing the frequency of travel. This finding confirms in part that of Poku-Boansi and Marsden [44] and Poku-Boansi and Cobbinah [45] who found that people shift between travel modes than simply giving up a trip they would have made because of the unreliability of public transportation. This is because even though some passengers have shifted from the use of motorised transport to walking, others have reduced the frequency of travel and only undertake trips that are deemed essential. Walking was thus not mainly patronised for purposes of safety as is widely known (see [50]), rather for cost, convenience and accessibility purposes. This again corroborates the view of Vanderschuren and Phayane [55] who embrace NMT as the optimal mode of transport for availability, affordability and health in addition to the safety reasons.

**Waiting and Travel Times (Trip Duration)**

Relevant to understanding the efficiency of a transport service is the waiting time for a bus and the travel time from an origin to a destination [55]. Hence, passengers’ perception on the waiting and travel times of public transport services in the city was examined, and consequently, the relationship between travel time (as dependent variable) and waiting time (as the independent variable) for public transport (trotro) was established. The finding generally showed a weak positive relationship between the two variables with a correlation coefficient of 0.43 and a coefficient of determination

of 0.185 (18.5%). The finding thus indicates that waiting time only cause an 18.5% variation in travel time of a public transport service. Hence, other factors (such as traffic congestion, speed of the vehicle, drivers' skills among others) may explain the remaining 81.5% variation in (or affect the duration of a travel) travel time of a trip (Fig. 2). As shown in Fig. 2, an average of 18% waited between 5 and 9 min for a bus, 13% waited between 10 and 14 min, while about 12% waited between 30 and 60 min for a bus. Again, the travel time for most of the passengers (26%) was between 30 and 60 min.

It was observed that the average waiting-time for trotro from Abrepo-Junction and Tech-Junction to the CBD (Adum and Kejetia) ranged between 5 and 9 min on a normal weekday. However, in extreme cases, waiting time to board trotro in Kumasi ranged between 30 and 60 min (SD = 19) with skewness of 24 min (indicating that reported cases of extreme waiting time mostly lie within 24 min) during the peak periods, i.e. morning (6:30–8am) when most passengers head to work and evening (4–7 pm) when most passengers head back home from their various work places. The results further showed that the average travel time over the same distance on an extreme day (traffic congestion) was about a minimum of 1 h 45 min and maximum of 4 h due to the difficulties in moving in and out of the CBD as a result of traffic and human congestion, obstructing flow of traffic, worsening use of the road space with adverse safety implications. This phenomenon presents the interplay of demand and supply as indicated by Poku-Boansi and Adarkwa [43]. This was further confirmed by a passenger as follows:

*“The waiting time for a trotro in the morning (between 7am and 10am) when going to work is hectic and challenging. I at times have to wait for about 25 minutes to access a trotro. On a normal day (between 1 and 4pm),*

*it takes me less than 5 minutes to get a trotro to any destination”. [A passenger at Tech Junction]*

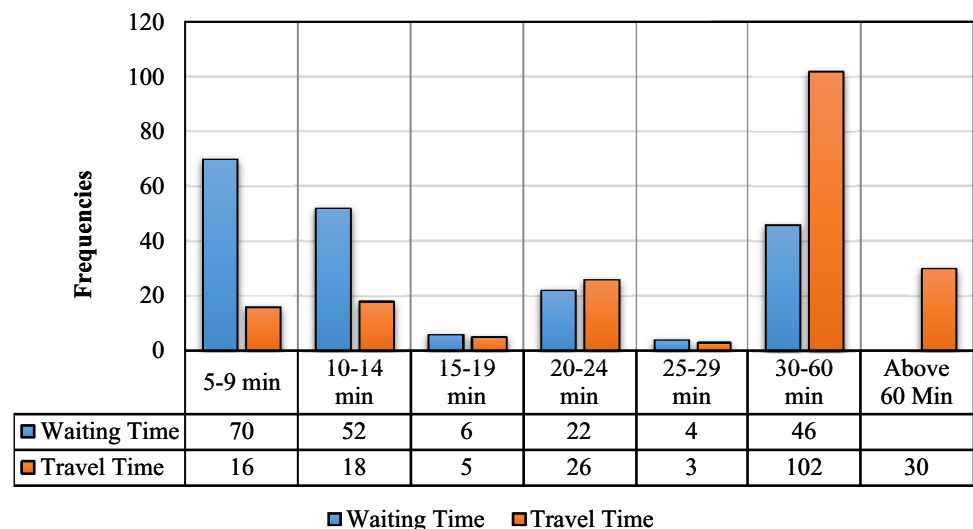
On the above, an official of the GPRTU remarked that:

*“It is understandable to experience intense traffic and longer waiting and travel time in the mornings (6:30am to 9am) and evenings (5pm to 8pm), because these are the peak demand periods. We do our best to make available the needed service to the increasing customers, but it is just difficult to handle the traffic situation because of the nature of road transport infrastructure/system”*

Officials of the GPRTU and PROTOA stated that traveling at a speed of 20-40 km/h to the CBD from Tech-Junction (distance of 7 km) and Abrepo-Junction (distance 3.9 km) requires between 10 and 15 minutes to cover the distance. On the contrary, combining the average waiting and travel time, trip durations spanned between 1 h 51 min on a normal day (which would have been healthy and saved time for individual walking at a rate of 4.5 km/hr [6]) and 4 h 7 min during peak periods within the same speed. This is deemed very unfavourable with enormous adverse socioeconomic implications when compared to the nominal value intervals of 96 and 120 min. Poku-Boansi and Adarkwa [43] attribute this phenomenon to the disintegration of trips by public transport operators, especially during peak periods to accrue higher fares for the same distance of journey and the extreme traffic congestion within the CBD due to the increase in private automobile usage, coupled with the few existing road infrastructure and on-street economic activities.

Similar to other parts of the country, public transport unless hired, do not depart the loading terminal until they are filled to capacity. In this regard, passengers and drivers alike spend extra minutes waiting for a bus to get full. As earlier

**Fig. 2** Waiting and travel times for public transport services





indicated, the waiting period at these bus terminals depends to a large extent on the time of the day as well as the day of the week. During peak periods, usually early mornings and late evenings, loading durations are relatively short compared to the other times of the day. In a similar way, weekend trips are characterised by relatively longer durations than weekdays. It was observed that public transport operators (particularly, those who are not members of either GPRTU, HERITAGE or PROTOA), during peak periods, exploited passengers, where all of the respondents indicated that they pay more than actual fare levels during such periods due to the increased demand over supply. For instance, it was gathered that the ‘normal’ fare from Tech Junction to the CBD was GH¢1.80 indicating a cost of GH¢0.20/km. During peak hours, the fare increases by 12%/km to GH¢2.02. This was same within all study neighbourhoods.

According to officials of GPRTU, PROTOA and HERITAGE, they are unable to fully carry out their mandates as a result of the weak implementation of regulations, poor coordination among transportation agencies as well as limited transport infrastructure. The excess payment because of the illegal behaviour of drivers places enormous stress on the travelling public which sometimes results in conflicts due to passengers’ resistance to pay such fares. This finding portrays some level of indiscipline and limited regulation of activities of transport operators as similarly revealed in a study by Poku-Boansi and Adarkwa [43].

### The Condition of Vehicles and Working Environment

The physical conditions of vehicles and work environment are widely reported to influence passenger’s decision to patronise a transport service [42, 43]. Studies report that overage and rickety vehicles have an inverse relationship with public transport mode and preference for choice of mode. Hence, the older the age and rickety a vehicle, the less demanding passengers will board or patronise such service, and vice versa, all things being equal. On this, findings showed that approximately 21.5 and 57% of the passengers interviewed rated conditions of vehicles used by public transport operators and work environments, respectively, as poor. Further observations confirmed the state of disrepair and rickety nature of the vehicles primarily due to poor maintenance routine practices by operators (such as seats, spacing of the seats, paintings and others that enhances vehicles’ appearance (interior and exterior). Discussions with officials of the transport unions showed that operators of public transport are mostly concerned about mechanical functioning of the vehicle, including the changing of oil, replacing fuel and air filters, clutch, brakes and engine maintenance. To the officials, inasmuch as the physical conditions of vehicles are necessary to attract passengers, they deemed the mechanical conditioning of vehicles as of

much relevance, although they often encourage members to ensure their vehicles are always in good physical condition. This was further reiterated by officials of the GPRTU and PROTOA as follows:

*“I do understand and agree that the beauty (interior designs, seat, exterior) of vehicles do attract passengers during periods where they have several options of vehicles to choose from. It should however be pointed out that a beautiful car with poor engine and other mechanical faults, is not worth patronising. You do so at your own risk....” [Interview with an official of GPRTU]*

*“We largely ensure that our members work on their engines, check their oil and replace them periodically and conduct other necessary mechanical checks. Issues of painting or beautifying an interior or exterior of a vehicle are secondary, although we do encourage them to do so. There is not enough money to do all that...” [Interview with an official of PROTOA]*

*‘An operator of the intra city transport indicated that some of them do not own the vehicle but work for their masters, as such final decisions are usually made by them, thus the difficulty in getting the mechanical aspects done as well as the exterior as that is good for the service, but because there is no enforcement some masters will not comply’ [Interview with a operator of trotro operator, Kejetia]*

The above findings on the physical conditions of vehicles show little semblance of consensus amongst passengers and officials of transport unions. Although both groups of respondents agreed that the physical condition of vehicles has influence on the efficiency of public transport service, officials deemed other mechanical issues as more important, whereas the operators wish they had both if within their purview. This in a way goes to suggest measures of consciously addressing issues of rickety vehicles as it is widely known that Ghana’s public transportation system uses rickety and over aged vehicles [42, 43], a phenomenon which is further compounded by a poor maintenance system resulting in frequent breakdowns and limited supply of public transport services.

On the working environment within which public transport service providers operated, it was observed that bus terminals were overcrowded, lacked adequate sanitary facilities (solid waste collection bins, toilet and water facilities), noise and air pollution from vehicles and pedestrians, resulting in safety challenges among others. The findings showed that about 57% of the passengers regard the working environment (condition of bus terminals) as poor with 13% describing existing conditions as good. Expert interviews with the GPRTU, PROTOA and HERITAGE officials revealed that agencies responsible for ensuring efficient public transport

service provision were unable to undertake proper supervision of operators' activities, resulting in the poor service conditions at the bus terminals. It was revealed that operators mainly benefitted from the vehicular spaces given them to load. This is so due to the payment made by operators known as "booking fee"—a fee charged to secure a parking space for passenger loading. The only support gained by members (operators) of the various transport associations was reported to be generally on welfare support when one has lost a spouse or parent and food packages during festive periods. This indicates that the established institutions in charge of transport operations efficiency have failed in their core mandate which is to ensure the efficiency and effectiveness of service delivered by public transport operators. Executives of the GPRTU, PROTOA and HERITAGE associations, however, stated though they did ensure that the working environments were cleaned every morning. However, due to the activities of the increasing number of passengers and vehicles as well as other economic actors, the designated spaces get filled with dirt as the day goes by.

*"It is not like we do not clean the place. We do that early in the morning. However, as the day goes by and the number of passengers, vehicles and those engaged in trading increase, the volume of solid waste disposed of indiscriminately increase, making the place dirty again. We admit that we do not have adequate bins to cater for that. It is however not our responsibility to provide bins, rather the city authorities."* [Interview with an official of GPRTU at Tech Junction]

The above findings corroborate earlier research works that poor state of vehicles and working environment may have contributed to the low quality of public transport service, making it unattractive to the high-class groups. Hence, the need to be critically addressed in order to improve efficiency and quality of the public transport sector.

### Service Safety and Comfortability

The growth in urban population in Africa is noted to be consequential to increasing transportation challenges such as comfort and safety issues. Most of the passengers indicated that patronising either a low or high occupancy public transport service or not was largely influenced by safety concerns. Hence, irrespective of the time they have to spend to get to their various destinations, they would always prioritise their safety. Although safety was ranked second to availability in terms of reasons for patronising public transport, most passengers (58%) rated the safety of existing public transport services as good, 27% fair and 15% poor (see Table 3). Passengers indicated that the probability of being exposed to physical harm (robbery) when using public transport, preferably trotro, is

low as compared to low occupancy vehicle (taxi) with a maximum capacity of four passengers. Similarly, Govendar [22] examined service quality in South Africa's road public transportation industry focussing on bus and mini-bus taxi services and found that safety influences service efficiency and quality of public bus services. This was reiterated by some passengers:

*"My safety is my number one concern. It doesn't matter where my destination is and how long it would take me there, so long as my safety is not assured, I will not patronise the service"* [A passenger at Adum]

*"I always feel safe using a high occupancy public transport service (trotro) compared to the taxi because of the number of passengers, not necessarily the condition of the vehicle. I only have to take care I do not get cut by any part of the vehicle."* [A passenger at Kejetia]

*"As for safety, it is very key whenever using a public transport, whether taxi or trotro. It is something we all have to pay attention to things like the tyres and also advisable to board those which belong to recognizable associations such as GPRTU. You however can never know that. We should all be always careful"* [A passenger at Tech-Junction]

Service comfortability was, however, generally rated poor (57%) by respondents due to the discomforts involved in using public transport. Generally, vehicles used in public transport (trotro) operations in Kumasi is below standard convenient unit that gives minimum comfort to passengers. The standard convenient unit gives some characteristics and dimensions of the public transport vehicle which assure the comfort of passengers. According to Marquez and García [34], seat-height for public transport should be 39.3 cm maximum, leg room-70 cm, seat width-31 cm, seat inclination 14–24°. Premised on the aforementioned standards, it was observed that the interior unit of most vehicles used for public transport are below standard dimensions and characteristics. Passengers complained about the worn-out seat upholstery, heat emanating from engine compartment, passenger-overloading, insufficient space to accommodate legs (legroom), poor inclination of back rest, and small width of the individual seats. For instance, it was observed that the legroom of the vehicles is mostly between 45 and 59.7 cm maximum and the heights of the seats are either too low (24.5 cm) or too high (44.5 cm). These, according to passengers made it uncomfortable to commute in such vehicles.

*"Most of the trotro I use are very uncomfortable. There is not enough space for my legs. You always have to assume a different posture, which often inhibits the comfort of the one seated next to you."* [A passenger at Abrepo-Junction]

The above indicates that although people patronise the trotros, it can be very discomfoting which means that the authorities concerned should endeavour to enforce the regulation to make passengers comfortable. As similarly observed by Yeboah and Asibey [60], there was increased commercial activities with limited consideration for pedestrian safety and comfort within the CBD. The surrounding spaces were observed to have been encroached upon by unauthorised physical developments, raising safety concerns of pedestrians and other road users. It was also observed that there were inadequate responses by city authorities to provide facilities (such as bus stops, pedestrian walkways) to address congestion, parking, overcrowding, vehicular–pedestrian conflicts and safety issues as similarly reported by Amoako et al. [5] and Yeboah and Asibey [60]. This buttresses Takamine’s [53] observation that policymakers in developing regions interpret urban transport system as a rather securing vehicular mobility than human safety, which applies to the state of Kumasi’s CBD.

### Information and Customer Care

Most passengers remarked that information (26%) and customer care (61%) services rendered by operators were poor. It was revealed that passengers and operators mostly end up in arguments concerning respective stops and fares due to poor information or communication. Due to the informal and largely unregularised nature of activities of public transport operators, there were frequent cases of different charges by operators over the same distance, which often results in misunderstanding between operators and passengers. Unlike the developed world where passengers are given prior information on immediate stops, information concerning the immediate stops in most Ghanaian cities, including Kumasi, is assumed and not announced to passengers. Hence, passengers who may be visiting a place for the first or not focussing on their trips end up at different destinations which often breed conflicts and arguments between the passengers and transport operators. This affects the constant efforts to promote efficient public transport service delivery in the city.

### Multiple-Linear Regression Analysis of Efficiency Indicators and Use of Public Transport

To understand the extent of influence of public transport service’s efficiency indicators on patronage or frequency of use of the service, a correlation analysis was undertaken. The result showed a coefficient of 0.93 and significant value of 0.000 which indicates a statistically significant and positive relationship between the predictor (efficiency indicators) and dependent (use of service) variables. Hence, according to passengers, the efficiency of a public transport service positively influenced its usage as efficiency indicators could

predict 86.5% variation in public transport usage, with other variables accounting for the remaining 13.5% variation in the dependent variable. Passengers are therefore willing to frequently use public transport that gives them maximum satisfaction and efficiency such as affordability, comfortability, safety, availability, and comfortability, among others [42].

A further breakdown of the regression analysis show that except affordability and trip duration, all other efficiency indicators have positive relationship with the use of public transport. All the efficiency indicators had a statistically significant relationship with use of public transport service since all their  $p$  values were  $p \leq 0.05$  (See Table 4).

This representation from the negative beta index value ( $-0.421$ ) indicate that an increase in transport cost will result in a decline in the use of public transport by approximately 42%, i.e. the affordability of using public transport, according to the passengers has a significant inverse relationship with the use of public transport. This in a way corroborates the assertion of Grzelec and Jagiełło [23] that passengers are highly sensitive to price changes. Similarly, an increase in trip duration (in terms of waiting and travel time) will cause a tangential decline in the use of public transport by approximately 28%. However, beta indices and significant coefficients of the other efficiency variables show that an improvement or increase in any of them will result in an increase in the use of public transport service, and vice versa. The above findings have demonstrated that transportation is an unconditionally necessary means to an end [20, 25]. This is due to the fact that transportation offers people the opportunity to engage in the various activities (such as work, school and leisure) that constitute their daily lives [16, 31]. Furthermore, the spatial segregation of land uses that takes place in most cities [8] requires that people travel in order to access the facilities and services that they need [29, 30]. It should be reiterated that improved service, among others, lead to an increase in patronage with associated positive and adverse outcomes. This implies the need to promote safety, comfortability, customer care, information, condition of vehicle and working environment in order to increase passenger’s continuous patronage of public transport service [33, 38, 40, 43].

### Conclusion and Policy Recommendations

The study sought to examine the efficiency of intra-city public transport in Kumasi, based on affordability, availability, comfortability, safety, condition of vehicles, working environment, information, customer care, and trip duration. The findings showed that contrary to other studies, users of public transport in Kumasi do not use the service because it is affordable but mainly due to service availability. Among

the indicators used to measure efficiency of public transport service, the most rated poor were customer care, working environment and comfortability of users. These were as a result of the poor attitude of operators towards passengers, poor regulations and management of the terminal surroundings by relevant transport associations such as GPRTU, PROTOA, HERITAGE and other agencies responsible for promoting efficient transport service delivery in Kumasi. The lack of maintenance of operating vehicles by operators and the use of overaged and rickety vehicles were reported to have contributed adversely to patronage and comfortability of users. Though these inefficiencies are confronted by users of public transport, the availability, safety and affordability of the service leave users with limited options but to patronise the service as delivered and rather reduce travel frequency and purpose.

Premised on this study's findings, the paper recommends that there should be measures consciously to address the identified challenges and improve efficiency of public transport service delivery in Kumasi. Addressing from order of priority, at the central government level, the Ministry of Transport can coordinate the formulation of restraining policies to improve operating efficiency of public transport services. These restraining policies should have interventions such as a wider range of public transport means to enhance mobility with less reliance on private ridership. Improvement in existing road infrastructure by the government, introducing option value (the possibility of having a wide range of alternatives for travel options) to ensure competition which can lead to service improvement and decentralised activities to deter most people from going to the CBD to engage in them are recommended. Providing efficient public transport involves an all-inclusive strategy by practically addressing transport related challenges from the root causes such as addressing traffic congestion and proper monitoring of service delivery by operators. Therefore, agencies responsible for ensuring efficient public transport must adequately focus on effective supervision and control of service delivery, by properly managing operators' activities to enhance quality of service and make public transport economically and socially attractive. The achievement of this, can lead to similar implementation in other major cities so as to make transport operation lucrative and attractive to promote efficiency and patronage at large. A good networked public transportation system with time-bound schedules, reliable services, comfort, competitive travel times, and affordable prices, are some of the required traits for providing sustainable transport services and commuter satisfaction.

The major limitation encountered in undertaking the study was the absence of the details of total population of the city and number of people generally availing the identified transport facilities and others across the city and other transport services. This affected the quest to scientifically

determine a sample size and respondents for the study. This, as was reported, informed the use of the convenience non-probability sampling method (based on participant's availability and willingness) to interview the study participants in the various study locations. The study, premised on this limitation, findings and recommendations, suggests that future studies can expand the scope to cover other terminals of the city and other cities and number of research participants to further understand the factors that influence the patronage of public transport services in the city. A comparative analysis of the bus terminals could be done to better examine the variations in responses on the factors that determine efficiency and patronage of public transport in the city and other major cities in Ghana. There is also the need for future research works to examine the perspectives of drivers of trotros and taxis and leaders of transport unions and relevant city agencies on the factors that influence patronage of public transport services in the city. This can inform future policies on putting place measures to ensure a well-improved public transport sector by basically ensuring that services rendered by operators meet the needs of users. Future studies can also be conducted to understand the factors influencing use of public transport among high, middle and low income groups. This is important considering studies that point out that income status of an individual has significant influence on the choice of a mode of travel. Lastly, considering calls for sustainable approaches towards efficient transport sector and holistic city development, further studies are required to thoroughly understand what is required for a participative, collaborative approach in which public transport actors and passengers develop shared transport planning goals, specifically on what influences decisions to use public transport, and agree on the means to give effect to those goals towards a well-improve sector and a sustainable trajectory.

**Supplementary Information** The online version contains supplementary material available at <https://doi.org/10.1007/s40890-021-00131-6>.

## Declarations

**Conflict of Interest** None.

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