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A Cross-Sectional Analysis of Caesarean Sections in The Light of The 10-Group Robson Classification System: The First Report from Somalia

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A Cross-Sectional Analysis of Caesarean Sections in The Light of The 10-Group Robson Classification System: The First Report from Somalia

Background Caesarean section (CS) is an important indicator of access to, and quality of maternal
 health services. The World Health Organization (WHO) recommends the Robson 10-group
 classification system as a global standard for assessing, monitoring and comparing CS rates at all levels.
 This study was designed to determine the share of CSs in deliveries performed in a tertiary referral
 centre in Somalia as assessed in the lens of the 10-group Robson classification system.

Design This retrospective study included data on consecutive mothers who had deliveries from January
 1, 2022, to July 1, 2023.

Methods Data were categorised according to the Robson Classification Report table as designed by
 seven columns. Each patient's data were coded according to the Robson specifications and after
 computing group variables, multiple response analysis was made.

Results A total of 3030 deliveries were analysed. Of these 1,156 (38.15%) were CS. Among the five most populated Robson groups, the highest absolute contribution to CSs was found in Group 5 with 11.35% followed by Group 10 with corresponding contribution of 9.4%. In the remaining three Robson groups (Group 1, 3, 4), the absolute contribution showed an acute decrease starting with Group 1 to 3.86%, with incremental decreases to 3.4% in Group 3 and to 3.33% in Group 4. The total share of the five most populated Robson groups in terms of CSs among all deliveries (n=3030) was 31.34%.

Conclusion Identification of the Robson groups that contribute the most to the overall CS is important
 to determine possible modifiable factors in our attempts to reduce the CS rate. Our findings show that
 Somalia has a long way to attain desirable CS rates within each Robson category.

Key words: Caesarean section, Robson Classification, Somalia

Ethics approval and consent to participate

The study was approved by the Mogadishu Somali Turkey Training and Research Hospital Ethics and Research Committee (Permission number: MSTH/15148/22.08.2023/827). The study was performed in accordance with the principles and guidelines of the Declaration of Helsinki. Analysis and reporting of the results are in compliance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.

STRENGTHS AND LIMITATIONS OF THIS STUDY

The sole limitation to our study is that relatively higher thresholds for gestational age (≥ 28 weeks) and birth weight ($\geq 1,000$ g) were accepted to define foetal viability, which is reasonable given the present circumstances of newborn intensive care in Somalia.

Nonetheless, the current study has two strengths to be mentioned. It represents the first study in Somalia reporting delivery data as concerned with the Robson criteria, with complete availability to relevant data. Secondly, as compared with similar studies of Robson criteria conducted in African countries, the study involved a relatively large sample size.

A Cross-Sectional Analysis of Caesarean Sections in The Light of The 10-Group Robson Classification System: The First Report from Somalia

INTRODUCTION

The World Health Organization (WHO) announced in 1985 that the rate of caesarean section (CS) should not exceed 10–15% regardless of the region or country.¹ This was not only necessary due to the potential maternal and perinatal CS-associated risks, but also to inequities that emerged with the growing practise of CS concerning accessibility to and affordability of CS .¹ Later in 2001, Michael Robson attempted to classify CSs based on the following obstetric variables: parity, previous CS, onset of labour, number of foetuses, gestational age, and foetal presentation; hence the 10 Robson groups. Each group represents the absolute and relative contributions to the overall CS rate, with higher contributions than specified in the Robson criteria indicating problems in the management of pregnant women and their deliveries. This includes factors related to obstetric policies, the training and experience of obstetricians, and the education and awareness of pregnant women.²

Since then, there have been a considerable number of studies aiming to reflect CS rates in individual health care facilities, which provide a general impression about the frequencies of CS.³⁻⁵ These reports have mainly come from countries with well-established health care systems, which is not the case for Sub-Saharan African countries and other low-income countries. According to the 2017

WHO report, Somalia is among countries in which no report is available concerning CS rates in the light

of the Robson criteria.6

This study was designed to determine the share of CSs in deliveries performed in a tertiary referral centre in Somalia as assessed in the lens of the 10-group Robson classification system.

12 METHODS

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Study design and participants

This retrospective study included data on 3030 consecutive mothers who had deliveries from January 1, 2022, to July 1, 2023, at the department of obstetrics of Mogadishu Somali Turkey Training and Research Hospital in Mogadishu, the capital city of Somalia. it is a dedicated centre particularly for high-risk and referred cases.

20 Data collection

21 Data on pregnant women were retrieved from admission-to-discharge electronic hospital records and 22 delivery registries. In addition to maternal age and a detailed inquiry into the past obstetric history of 23 each participant, including parity and previous CS, particular attention was given to delivery-specific 24 25 information concerning parity (nulliparity or multiparity), onset of labour (spontaneous, induced, or CS 26 before labour), foetal presentation/lie (cephalic, breech, transverse or oblique), number of foetuses 27 (single or multiple), mode of delivery (vaginal or CS), and gestational age (term or preterm). Neonatal 28 data included stillbirths, APGAR score, birth weight, and the need for admission to the neonatal 29 intensive care unit (NICU). 30

All women underwent ultrasound examination at admission. Gestational age was calculated from the last menstrual period in combination with obstetric ultrasound examination performed until 20 weeks of pregnancy. In case of unknown last menstrual period or no early ultrasound, gestational age was estimated based on admission ultrasound examination. Birth weight < 2,500 g was considered preterm and birth weight \ge 2,500 g was considered term. This strategy has been employed in other studies conducted in similar settings.^{3,7,8}

Inclusion criteria were maternal age 15-47 years, at least 28 weeks of gestation, and a birth weight of at least 1000 g. Women were excluded in the presence of any of the following: uterine rupture, any traumatic wound that could affect delivery, (<28 weeks), birth weight (<1,000 g) and incomplete clinical or hospital data.

Seven mothers had uterine rupture, one mother was shut gun CS. Data from 60 women could not be completed and were considered missing. These patients were not included in the final analysis.

Caesarean Section Rate based on Robson criteria

Data were categorised according to the Robson Classification Report table [6] as designed by seven columns: Column 1 indicating the type of the group; Column 2 number of CS in group; Column 3 Number of women in group; Column 4 Group Size (%); Column 5 Group CS rate (%); Column 6 absolute group contribution to overall CS rate (%) and Column 7 Relative contribution of group to

overall CS rate (%). Absolute contribution was defined as the percentage of the number of CSs in each group divided by the total number of women delivered in the hospital during the study period. Relative contribution was defined as the percentage of the number of CSs in each group divided by the total number of CSs performed in the hospital during the study period.

Data processing and analysis

Data were processed using the Statistical Package for Social Sciences (SPSS) version 29 (IBM Corp., Armonk, N.Y.; USA). Quantitative data were expressed as means, standard deviation (SD), median, minimum, and maximum, and qualitative data as frequencies and percentages. Each patient's data were coded according to the Robson specifications and after computing group variables, multiple response analysis was made.

RESULTS

Sociodemographic and obstetric characteristics

During the study period, 3097 women were admitted for delivery, of whom 3030 were eligible for the analysis. A total of 67 women were excluded because of incomplete clinical or hospital data (n=60), uterine perforation (n=6) and gunshut (n=1). The characteristics of the participants are summarised in Table 1. The mean age was 26.5±5.6 years (range 15-47). The median parity was 3 (range 1-15). A total of 2966 single and 64 multiple (63 twins, 1 triplet) deliveries occurred at a mean of 37.7±3.1 weeks (range 28-42). Of 3030 women, 1874 (61.85%) had NVD and 1156 (38.15%) had CS.

The mean birth weight was 2,959±743 grams. A total of 550 women had no early ultrasound examination or could not remember their last menstrual period; therefore, gestational age was estimated based on ultrasound examination and birth weight.

During the 18 months of the study, according to the Robson classification, the first five most populated patient groups in descending order fell into Robson groups of 3, 10, 1, 5, and 4. The largest proportion of the deliveries (n=1188, 39.2%) fell into Group 3, featuring multiparous women with no previous CS, \geq 37 gestational weeks, single foetus, and cephalic presentation, ending with spontaneous labour. The next largest proportion (n=632, 20.9%) met the criteria for Group 10, featuring all preterm, single deliveries with cephalic presentation, including previous CSs. Group 1 included 477 deliveries (15.7%), featuring nulliparous women, \geq 37 gestational weeks, single foetus, and cephalic presentation, ending with spontaneous labour. The fourth place was taken by 351 deliveries (11.6%) and fell into Group 5, having the features of \geq 37 weeks of gestation, single foetus, cephalic presentation, and all previous deliveries by CS. The fifth most common form of deliveries (n=122, 4.0%) had the characteristics of Group 4, with multiparous women with no history of previous CS, \geq 37 gestational weeks, single foetus, and cephalic presentation, ending with induction of labour or CS before the onset of labour (Table 2).

In these five groups (Group 3, 10, 1, 5, and 4), rates of CS were 8.7% (103/1188), 45.1% (285/632), 24.5% (117/477), 98.0% (344/351), and 82.8% (101/122), retrospectively (Table 2).

Among the five most populated Robson groups, the highest absolute and relative contributions to CSs was found in Group 5 with 11.35% and 29.8%, respectively, followed by Group 10 with corresponding contributions of 9.4% and 24.7%. In the remaining three Robson groups (Group 1, 3, 4), the absolute and relative contributions showed an acute decrease starting with Group 1 to 3.86% and 10.1%, respectively, with incremental decreases to 3.4% and 8.9% in Group 3 and to 3.33% and 8.7% in Group 4 (Table 2).

The total share of the five most populated Robson groups in terms of CSs among all deliveries (n=3030) was 31.34%. The total share of the same groups in terms of CSs among all CSs (n=1156) was 82.2% (Table 2).

DISCUSSION

According to the most recent the World Health Organization (WHO) 2017 report, Somalia is indicated among a few countries where no data are said to be available concerning the Robson classification⁶; hence, CS rates with a considerable sample size (n=3030) and long period of analysis (18 months), the current study represents the first comprehensive report from one of the most specialised hospitals in Somalia delivering healthcare to high-risk patients, particularly with services to pregnant women and newborns.

The Robson classification was developed and has been proposed to be used as a tool to monitor and compare CS rates in the same setting over time and between different settings, amid a progressive increase in the rate of deliveries by CS worldwide, posing a major public health concern about potential maternal and perinatal risks, inequity in access and cost issues.⁶

Our findings show that, during an 18-month period, a total of 3030 women delivered for which 1217 CSs were performed. Based on the Robson classification, Group 3 comprised the highest number of women (n=1188, 39.2%) contributing to CSs with an absolute rate of 3.4% and a relative rate of 8.5%. In comparison with reports from developed countries⁹⁻¹¹, the size of Group 3 was considerably larger, which is consistent with the social characteristics of Somalia where women have more than one child rather than only one child. However, the absolute and relative contributions of Group 3 to CSs were relatively greater than reports from developed countries, mainly because of the hospital's referral status for high-risk pregnancies (severe preeclampsia, vasa previa, and intrauterine growth retardation, etc.) as well as due to some degree of indiscriminate CS applications. In accordance with the WHO recommendation, it would be reasonable to assess Group 3 together with Group 4 because of similarities

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in the characteristics of the two groups (multiparous, single cephalic, \geq 37 weeks, and no previous CS) except for the type of labour onset (spontaneous versus induced or CS) [6]. Despite being the fifth most populated group, the size of Group 4 was 4.0%, with absolute and relative contributions to CS of 3.33%, and 8.7%, respectively. The sum of the two group sizes was 43.2%, which is greater than 30% proposed by the WHO for countries where women usually have the first child. The WHO states that for women with more than one child, this sum may exceed 30%⁶, which is just the case for Somali women. Among reproductive women in this cohort, the rate of multiparity was 72%, accounting for the higher rate for the sum of the two groups.

In Group 10, which had the second largest size with 20.9%, the absolute and relative contributions of the group were 9.4%, and 24.7%, respectively. This group size was considerably greater than 5% reported by the WHO for normal risk settings, as well as by studies from Germany (12.2%)⁹ and Ethiopia (15.9%).³ This finding has main implications: a fifth of reproductive Somali women have the problem of preterm deliveries which also pose other challenges such as foetal growth restriction or pre-eclampsia and other pregnancy or medical complications. As a corollary, 45.1% of women having these problems underwent CS in this group, accounting for nearly a quarter of all CSs performed in this cohort. This also indicates the crucial importance of Turkey Hospital in the capital city of Somalia serving Somali women as a tertiary referral centre with highly dedicated healthcare professionals and a sophisticated obstetric clinic and NICU.

In our analysis, the CS rates in Group 1 and Group 2 were considerably higher at 24.5% and 85.1%, respectively, as compared with the original WHO recommendation of 9.8% and 39.9%, respectively, and other reports in the literature.^{3,9-11} This discrepancy mainly resulted from the higher number of women who had been referred to our centre with a diagnosis of severe preeclampsia. This phenomenon is a unique problem to underdeveloped countries like Somalia, where access to prenatal monitoring is extremely restricted because of limited sources and the low level of education. Another feature that distinguishes Somalia from many countries is that pregnant women are free by law to choose CS either before or after initiation of spontaneous labour. These two factors might be influential in making Group 1 the third, and Group 2 the sixth significant contributors to the overall CS rate.

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In Group 5, we found the second highest CS rate at 98.0% following Group 9 (100%). This is reasonable because this group involves pregnancies following previous CS where subsequent CS is almost inevitable. There appears to be two ways to decrease the CS rate in this group as well as the rates of absolute and relative group contributions to the overall CS. As the necessity for CS primarily arises from a previous CS, the CS rate in Group 5 cannot be reduced unless CS rates are lowered in the preceding groups. Second, the routine practise in obstetrics unfortunately is adopting a CS strategy following a previous CS, despite the presence of a universal consensus about the safety of and thus the necessity for a subsequent vaginal delivery in eligible women following a single previous lower segment CS. Therefore, attempting vaginal delivery in this setting would decrease the CS rate in Group 5.

CONCLUSIONS

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15 16 Identification of the Robson groups that contribute the most to the overall CS is important to determine possible modifiable factors in our attempts to reduce the CS rate. Our findings show that Somalia has a long way to attain desirable CS rates within each Robson category.

Ethics approval and consent to participate

The study was approved by the Mogadishu Somali Turkey Training and Research Hospital Ethics and Research Committee (Permission number: MSTH/15148/22.08.2023/827). The study was performed in accordance with the principles and guidelines of the Declaration of Helsinki. Analysis and reporting of the results are in compliance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.

2627 Consent for publication

2829 Not applicable.

Availability of data and materials

All data generated or analysed during this study are included in this article. The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. The corresponding author (email: dradilbarut@gmail.com) can be contacted for the data with a reasonable request.

Conflict of interest Conflict of interest

 $_{40}$ The authors declare that they have no competing interests.

41 Funding

This study has not received any funding.

45 Authors' contributions

All authors (AB,HB,UE.) made substantial contributions to the proposal design, data collection,
 analysis, report, writing and drafting the manuscript. All authors reviewed, revised and approved the
 final from manuscript.

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We would like to thank Somali women for their participation in this study.

5455 Abbreviations56

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⁵⁷ CS: Caesarean section, WHO: The World Health Organization, NICU:the neonatal intensive care unit,
 ⁵⁸ SPSS: Statistical package for social science; SD: standard deviation; STROBE: Strengthening the
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Reporting of Observational Studies in Epidemiology; USA: United States of America; IBM: International Business Machines.

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ן ר	Table 1 Clinica	l and obstetrics	characteristics	of the part	ticipants (n=3	030)
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Characteristics	Number (n)	Percentage (%)
		r ereentage (70)
Age (years)		
18>	61	2.0
≥18 <35	2667	88.0
≥35	302	10.0
Parity		
Primiparity	849	28.0

Multiparity (2-4 deliveries) Grand multiparity (2	1266	41.8
deliveries) Grand multiparity (2)		
Grand multinarity (2		
	>5 915	30.2
deliveries)	_0 ,10	
Gestational age (weeks) ^a		
<37	698	23.0
>37	2332	77.0
Onset of Jabour		77.0
Spontaneous	2070	68.6
Induced	2079	24
CS hafara angat af	15	2.4
LS before onset of	408	13.4
	410	12.5
Previous CS	410	13.5
Foetal presentation/lie (sii	ngle	
pregnancy)		
Cephalic	2884	97.2
Breech	63	2.1
Transverse/Oblique	19	0.6
Number of fetus		
Single	2966	97.9
Multiple	64	2.1
Twins	63	
Tripled	1	
Mode of delivery		
Vaginal delivery	1874	61.85
Ceasarean section	1156	38.15
Mode of operation	1150	50.15
Emorgonov	520	15.8
Scheduled	529	45.0
Scheduled	027	34.2
Foetal outcomes	2002	
Live birth	2983	96.4
NICU admission	406	13.6
Stillbirth	. 112	3.6
Birth weight (g) (n=3095))b	
$\geq 1000 < 1500$	189	6.1
$\geq 1500 < 2500$	492	15.9
≥ 2500	2414	78.0
N:number, %:percentage, NICU ^a For 550 women with unknown weight < 2,500 g and were con	U: the neonatal intensive card 1 gestational age, birth weigh sidered < 37 weeks whereas	e unit, CS: Caesarean section, g:gram at was used as a proxy indicator, 134 newborns had birth 416 newborns had birth weight \geq 2,500 g and were
considered ≥ 37 weeks.	or of hobics have	
«Kate calculated per total numb	ber of bables born	
Table 2 The Robson Classif	ication Report Table	
Setting name: Mogadishu S	Somali Turkey Training ar	nd Research Hospital period: January 1, 2022, to July 1, 2

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Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7
Robson criteria	Number of CS (n=1516)	Number of women (n=3030)	Group Size ¹ (%)	Group CS rate ² (%)	Absolute group contribution to overall CS rate ³ (%)	Relative group contribution to overall of rate ⁴ (%)
Group 1: Nulliparous, single cephalic, ≥37 weeks, in spontaneous	117	477	15.7	24.5	3.86	10.1
Group 2: Nulliparous, single cephalic, ≥37 weeks, induced or CS before labour.	97	114	3.8	85.1	3.20	8.4
2a: Labour induced	7	24	0.8	29.2	0.23	0.60
2b [.] Pre-labour CS	90	90	3.0	100	2.97	7.80
Group 3: Multiparous (excluding previous CS), single cephalic,≥37 weeks, in spontaneous labour.	103	1188	39.2	8.7	3.40	8.9
Group 4: Multiparous (excluding previous CS), single cephalic, >37 weeks, induced or CS before labour.	101	122	4.0	82.8	3.33	8.7
4a: Labour induced	9	30	0.3	30	0.29	0.8
4b: Pre-labour CS	92	92	3.7	100	3.04	7.9
Group 5: Previous CS, single cephalic, \geq 37 weeks	344	351	11.6	98.0	11.35	29.8
Group 6: All nulliparous women with a single breech pregnancy	18	25	0.8	72.0	0.59	1.6
Group 7: All multiparous breeches (including previous CS)	22	38	1.3	57.9	0.73	1.9
Group 8: All multiple pregnancies (including previous CS)	50	64	2.1	78.1	1.65	4.3

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2 3	Crown Or All more an with a							
4	single pregnancy with a	19	19	0.6	100	0.63	1.6	
5	transverse or obligue lie.							
6	including women with							
7	previous CS(s)							
8 9	Group 10: All single	285	632	20.9	45.1	9.40	24.7	
10	cephalic, <37 weeks							
11 12	(including previous CS)							
13	These totals and percentages	s come from	the data in the	he table.	• .1 1 • . 1 1	00		
14	¹ Group size $(\%) = n$ of wom ² Group CS rate $(\%) = n$ of C	en in the gr	oup / total N	women delivered	in the hospital $x = 100$	00		P
15	³ Absolute contribution (%) =	= n of CSs i	n the group /	total N of womer	delivered in the h	ospital x 100		rote
16 17	⁴ Relative contribution (%) =	n of CSs in	the group / t	otal N of CSs in t	the hospital x 100			cte
18			0 1					Чр.
19	N:number %:percentage NICU	• the neonata	l intensive care	e unit CS [.] Caesare	an section gram			ч. Со
20	^a For 550 women with unknown	gestational ag	ge, birth weigh	it was used as a pro	oxy indicator, 134 ne	wborns had birth	weight	руг
21	< 2,500 g and were considered <	37 weeks w	hereas 416 nev	wborns had birth w	eight \geq 2,500 g and	were considered \geq	<u>-</u> 37	igh.
22 23	weeks. ^b Rate calculated per total	number of b	babies born					,t in
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A Cross-Sectional Analysis of Caesarean Sections According to the Robson 10-Group Classification System: The First Report from Somalia

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A Cross-Sectional Analysis of Caesarean Sections According to the Robson 10-Group Classification System: The First Report from Somalia

34 **Objectives** Caesarean section (CS) is an important indicator of access to, and quality of maternal health 35 services. The World Health Organization (WHO) recommends the Robson 10-group classification 36 37 system as a global standard for assessing, monitoring and comparing CS rates at all levels. Identification 38 of the Robson groups that contribute the most to the overall CS is important to determine possible 39 modifiable factors in our attempts to reduce the CS rate. This study was designed to analyse CS 40 deliveries performed in a tertiary referral centre in Somalia according to the Robson 10-group 41 classification system. 42

Design This retrospective study included data on consecutive mothers who had deliveries from January
 1, 2022, to July 1, 2023.

Methods Data were categorised according to the Robson Classification in seven columns. Each
 patient's data were coded according to the Robson specifications.

Results A total of 3030 deliveries were analysed. Of these 1156 (38.2 %) were CS. Among the five largest Robson groups, the highest absolute contribution to CSs was found in Group 5 with 11.4 % followed by Group 10 with corresponding contribution of 9.4%. In the remaining three Robson groups (Group 1, 3, 4), the absolute contribution showed an acute decrease starting with Group 1 to 3.9 %, with incremental decreases to 3.4% in Group 3 and to 3.3% in Group 4. The total percentages of CSs among all deliveries (n=3030) and among all CSs (n=1156) in the five largest Robson groups were 31.3% and 82.2%, respectively

Conclusion Our analysis showed higher CS rates in each category of the Robson classification system,
 which can be attributed to the current undesired level of healthcare in Somalia.

⁶⁰ **Key words:** Caesarean section, Robson Classification, Somalia

Strengths and limitations of this study

The sole limitation to our study is that relatively higher thresholds for GA (\geq 28 weeks) and birth weight (\geq 1,000 g) were accepted to define foetal viability, which is reasonable given the present circumstances of newborn intensive care in Somalia.

Nonetheless, the current study has two strengths to be mentioned.

It represents the first study in Somalia reporting delivery data as concerned with the Robson Ten Group Classification System with complete availability to relevant data.

Secondly, as compared with similar studies of Robson criteria conducted in African countries, the study involved a relatively large sample size.

Ethics approval and consent to participate

The study was approved by the Mogadishu Somali Turkey Training and Research Hospital Institutional Review Board (IRB) (Permission number: MSTH/15148/22.08.2023/827). Obtaining inform consent was waived by the IRB due to the retrospective design of the study. The study was performed in accordance with the principles and guidelines of the Declaration of Helsinki. Analysis and reporting of the results are in compliance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.

⁴ A Cross-Sectional Analysis of Caesarean Sections According to the Robson 10-Group ⁵ Classification System: The First Report from Somalia

7 INTRODUCTION

In 2015 and 2021, the World Health Organization (WHO) proposed adopting the Robson classification system, developed by Michael Robson in 2001, for assessing, monitoring and comparing CS rates over time and between different institutions, regions and countries.^{1,2} The Robson system include specific obstetric variables: parity, previous CS, onset of labour, number of foetuses, gestational age, and foetal presentation; hence the 10 Robson groups.³The WHO recommended the use of the Robson 10-group classification system for assessing, monitoring and comparing CS rates over time and between different institutions, regions and countries.³ In 2021 update, although the WHO does not recommend a specific CS rate for countries to achieve at population level, it is emphasized that CS rates up to 10% are highly associated with reductions in maternal and newborn mortality rates. In contrast, CS rates exceeding 10% have been shown to have no benefit in decreased maternal and newborn mortality and may cast doubt on the actual necessity of CSs.¹

In Robson classification, each Robson group represents a cohort of women with similar obstetric characteristics. CS rates higher than given in the Robson system may indicate problems in the management of pregnant women and their deliveries, resulting from obstetric policies, the training and experience of obstetricians, and the education and awareness of pregnant women.⁴

There have been a considerable number of studies aiming to reflect CS rates in individual health care facilities.⁵⁻⁷ These reports have mainly come from countries with well-established health care systems, which is not the case for Sub-Saharan African countries and other low-income countries. According to the 2017 WHO report, Somalia is among countries in which no report is available concerning CS rates in the light of the Robson criteria.³

This study was designed to analyse CS deliveries performed in a tertiary referral centre in Somalia according to the Robson 10-group classification system.

METHODS

12 Study design and participants

This retrospective study evaluated included 3097 consecutive mothers who had deliveries from January
 1, 2022, to July 1, 2023, at the department of obstetrics of Mogadishu Somali Turkey Training and
 Research Hospital in Mogadishu, the capital city of Somalia. it is a dedicated centre particularly for
 high-risk and referred cases.

Data collection

Data on pregnant women were manually retrieved from admission-to-discharge electronic hospital records and delivery registries by the authors and manually transferred to spreadsheets. Finally, all data and spreadsheets were independently checked by two obstetricians. In addition to maternal age and a detailed inquiry into the past obstetric history of each participant, including parity and previous CS, particular attention was given to delivery-specific information concerning parity (nulliparity or multiparity), onset of labour (spontaneous, induced, or CS before labour), foetal presentation/lie (cephalic, breech, transverse or oblique), number of foetuses (single or multiple), mode of delivery (vaginal or CS), and gestational age (GA) (term or preterm). Neonatal data included stillbirths, APGAR score, birth weight, and the need for admission to the neonatal intensive care unit (NICU).

All women underwent ultrasound examination at admission. Gestational age was calculated from the last menstrual period in combination with obstetric ultrasound examination performed until 20 weeks of pregnancy. In case of unknown last menstrual period or no early ultrasound, GA was estimated based on admission ultrasound examination. In addition to ultrasound examination at admission, birth weights < 2500 g and ≥ 2500 g were considered in favour of preterm and term deliveries, respectively. In case of inconsistency between ultrasound examination and birth weight, the decision for a term or preterm delivery was based on the birth weight. This strategy has been employed in other studies conducted in similar settings.5,8,9

Inclusion criteria were at least 28 weeks of gestation and a birth weight of at least 1000 g. Women were excluded in the presence of any of the following: uterine rupture, any traumatic wound that could affect delivery, (GA<28 weeks), birth weight (<1000 g) and incomplete clinical or hospital data.

Patients and public involvement

There was no patient or public involvement in planning or executing this study. There are no plans to disperse the results of our research to study participants or the applicable patient community. However, results are being disseminated among the professional communities of Somali and to policymakers, with

the intent to inform future health policy decisions. We would like to thank Somali women for their participation in this study.

Caesarean Section Rate based on Robson criteria

Data were categorised according to the Robson Classification Report table as designed by seven columns: Column 1 indicating the type of the group; Column 2 number of CS in group; Column 3 Number of women in group; Column 4 Group Size (%); Column 5 Group CS rate (%); Column 6 absolute group contribution to overall CS rate (%) and Column 7 Relative contribution of group to overall CS rate (%). Absolute contribution was defined as the percentage of the number of CSs in each group divided by the total number of women delivered in the hospital during the study period. Relative contribution was defined as the percentage of the number of CSs in each group divided by the total number of CSs performed in the hospital during the study period.³

Data processing and analysis

Data were processed using the Statistical Package for Social Sciences (SPSS) version 29 (IBM Corp., Armonk, N.Y.; USA). Continuous data were expressed as means, standard deviation (SD), median, minimum, and maximum, and categorical data as frequencies and percentages. Each patient's data were coded according to the Robson specifications and after computing group variables, multiple response analysis was made.

RESULTS

Sociodemographic and obstetric characteristics

During the study period, 3097 women were admitted for delivery, of whom 3030 were eligible for the analysis. A total of 67 women were excluded from the study. Six mothers had uterine rupture, one mother had gunshot-induced CS. Data from 60 women were incomplete. The characteristics of the participants are summarised in Table 1. The mean age was 26.5 ± 5.6 years (range 15-47). The median parity was 3 (range 1-15). A total of 2966 single and 64 multiple (63 twins, 1 triplet) deliveries occurred at a mean of 37.7 ± 3.1 weeks (range 28-42). Of 3030 women, 1874 (61.9%) had normal vaginal delivery and 1,156 (38.2%) had CS.

The mean birth weight was 2959±743 grams. A total of 550 women had no early ultrasound examination or could not remember their last menstrual period; therefore, GA was estimated based on ultrasound examination and birth weight or on the latter when there was inconsistency between the two.

During the 18 months of the study, the first five largest patient groups in descending order were seem in Robson groups of 3, 10, 1, 5, and 4. The largest number of deliveries (n=1188, 39.2%) was recorded in Group 3. The next largest number (n=632, 20.9%) was recorded for Group 10, followed by Group 1 with 477 deliveries (15.7%), Group 5 with 351 deliveries (11.6%), and Group 4 with 122 deliveries (4.0%). In these five Robson groups (Group 3, 10, 1, 5, and 4), CS rates were 8.7%

(103/1188), 45.1% (285/632), 24.5% (117/477), 98.0% (344/351), and 82.8% (101/122), respectively (Table 2).

Among these five groups, Group 5 had the highest absolute (11.4%) and relative (29.8%) contributions to CSs, followed with corresponding contributions in descending order by 9.4% and 24.7% in Group 10, 3.9 % and 10.1% in Group 1, 3.4% and 8.9% in Group 3, and 3.3% and 8.7% in Group 4 (Table 2).

Among all deliveries (n=3030) and among all CSs (n=1156), CSs accounted for 31.3% and 82.2%, respectively, in the five largest Robson groups (Table 2).

DISCUSSION

In 'Robson Classification Implementation Manual' released by the WHO in 2017, Somalia was depicted among the countries where there had been no data available on CS rates⁶. With CS rates of considerable sample size (n=3030) and long-period of analysis (18 months), the current study represents the first comprehensive report from one of the most specialised hospitals in Somalia delivering healthcare to high-risk patients, particularly with services to pregnant women and newborns.

The Robson classification was developed and has been proposed to be used as a tool to monitor and compare CS rates in the same setting over time and between different settings. Given the progressive increase in CS rates worldwide, the WHO considers this trend a major public health concern bringing about potential maternal and perinatal risks, inequity in access and cost issues.³

Our findings show that, during an 18-month period, a total of 3030 women delivered, for which 1156 CSs were performed. Based on the Robson classification, Group 3, which comprised the largest number of women (n=1188, 39.2% of the study population), contributed only 8.5% to the overall rate of CS (relative contribution). In comparison with reports from developed countries¹⁰⁻¹², the size of Group 3 was considerably larger, which is consistent with the social characteristics of Somalia where women have more than one child. However, the relative contribution of Group 3 to CSs was greater than reports from developed countries, mainly because of the hospital's referral status for high-risk pregnancies (severe preeclampsia, vasa previa, and intrauterine growth retardation, etc.). In accordance with the manual on Robson Classification, it would be reasonable to assess Group 3 together with Group 4 because of similarities in the characteristics of the two groups (multiparous, single cephalic, ≥ 37 weeks, and no previous CS) except for the type of labour onset (spontaneous versus induced or CS).³ Despite being the fifth largest group, the size of Group 4 was 4.0%, with a relative contribution to CS of 8.7%. The sum of the two group sizes was 43.2%, which is greater than 30% proposed by the manual for countries where women usually have the first child. The manual states that for women with more

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 than one child, this sum may exceed 30.0%³, which is just the case for Somali women. Among reproductive women in this cohort, the rate of multiparity was 72%, accounting for the higher rate for the sum of the two groups.

In Group 10, which had the second largest size with 20.9%, the relative contribution of the group was 24.7%. This group size was considerably greater than 5% reported by the manual for normal risk settings, as well as by studies from Germany (12.2%)¹⁰ and Ethiopia (15.9%).⁵ This finding has main implications: a fifth of reproductive Somali women have the problem of preterm deliveries which also pose other challenges such as foetal growth restriction or pre-eclampsia and other pregnancy or medical complications. As a corollary, 45.1% of women having these problems underwent CS in this group, accounting for nearly a quarter of all CSs performed in this cohort. This also indicates the crucial importance of Turkey Hospital in the capital city of Somalia serving Somali women as a tertiary referral centre with highly dedicated healthcare professionals and a sophisticated obstetric clinic and NICU.

In our analysis, the CS rates in Group 1 and Group 2 were considerably higher at 24.5% and 85.1%, respectively, as compared with the original manual recommendation of 9.8% and 39.9%, respectively, and other reports in the literature.^{5,10-12} This discrepancy mainly resulted from the higher number of women who had been referred to our centre with a diagnosis of severe preeclampsia. This phenomenon is a unique problem to underdeveloped countries like Somalia, where access to prenatal monitoring is extremely restricted because of limited sources and the low level of education. Another feature that distinguishes Somalia from many countries is that pregnant women are free by law to choose CS either before or after initiation of spontaneous labour. These two factors might be influential in making Group 1 the third, and Group 2 the sixth significant contributors to the overall CS rate.

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In Group 5, we found the second highest CS rate at 98.0% following Group 9 (100.0%). This is reasonable because this group involves pregnancies following previous CS where subsequent CS is almost inevitable. There appears to be two ways to decrease the CS rate in this group. As the necessity for CS primarily arises from a previous CS, the CS rate in Group 5 cannot be reduced unless CS rates are lowered in the preceding groups. Second, the routine practise in obstetrics unfortunately is adopting a CS strategy following a previous CS, despite the presence of a universal consensus about the safety of and thus the necessity for a subsequent vaginal delivery in eligible women following a single previous lower segment CS. Therefore, attempting vaginal delivery in this setting would decrease the CS rate in Group 5.

Considering the steps recommended by the Robson classification to assess type of population, we derived the following conclusions: For step 1, the sum of Group 1 and Group 2 was 591, yielding a percentage of 19.5%, being considerably lower than the ideal percentage of 38.1%. This discrepancy

arises from the unique characteristics of Somalia and other low- and middle-income countries where most of the population is represented by multiparous women, reducing the total size of Group1 and Group 2. Therefore, higher percentages reported from some African countries with similar characteristics to those of Somalia may cast doubt about their reliability.^{13,14} Our finding was consistent with a report from Eastern Ethiopia.¹⁵ For step 2, the sum of Group 3 and Group 4 (n=1310) corresponded to 43.2%. The proportion of multiparous women in Somalia now exerts a positive effect on this result. Group sizes for this step do not differ much across African countries.¹³⁻¹⁵ As for the step 3, the proportion of the size of Group 5 to the total CS rate was 30%, indicating a higher total CS rate in Somalia. The reported rates are 28% and 44% for Ethiopia¹³ and Tanzania¹⁴, respectively.

CONCLUSIONS

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Our analysis showed higher CS rates in each category of the Robson classification system, which can be attributed to the current undesired level of healthcare in Somalia.

Ethics approval and consent to participate

26 The study was approved by the Mogadishu Somali Turkey Training and Research Hospital Institutional 27 28 Review Board (IRB) (Permission number: MSTH/15148/22.08.2023/827). Obtaining inform consent 29 was waived by the IRB due to the retrospective design of the study. The study was performed in 30 31 accordance with the principles and guidelines of the Declaration of Helsinki. Analysis and reporting of 32 33 the results are in compliance with the Strengthening the Reporting of Observational Studies in 34 35 Epidemiology (STROBE) checklist. 36

Consent for publication

39 Not applicable.

40 41 Availability of data and materials

All data generated or analysed during this study are included in this article. The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. The corresponding author (email: dradilbarut@gmail.com) can be contacted for the data with a reasonable request.

48 49 **Conflict of interest**

⁵⁰ The authors declare that they have no competing interests.

52 Funding

⁵³₅₄ This study has not received any funding.

Authors' contributions Authors' contributions

All authors (AB,HB,UE.) made substantial contributions to the proposal design, data collection, analysis, report, writing and drafting the manuscript. All authors reviewed, revised and approved the final from manuscript.

Abbreviations

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CS: Caesarean section, WHO: The World Health Organization, NICU: The neonatal intensive care unit,

SPSS: Statistical package for social science; SD: standard deviation; STROBE: Strengthening the

Reporting of Observational Studies in Epidemiology; USA: United States of America; IBM:

Implementation

Classification:

9 International Business Machines. 10 11 12 13 14 15 References 16 17 1.https://www.who.int/news-room/guestions-and-answers/item/who-statement-on-caesarean-section-18 rates-frequently-asked-questions. Accessed 24 August 2024 19 20 2.https://www.who.int/publications/i/item/WHO-RHR-15.02.Accessed 24 August 2024 21 3.Robson 22 https://iris.who.int/bitstream/handle/10665/259512/9789241513197-eng.pdf?sequence=1:Accessed 24 23 August 2024 24 25 4. Robson MS. Classification of caesarean sections. Fetal and Maternal Medicine Review. 26 2001;12(1):23-39. 27 28 5. Abubeker FA, Gashawbeza B, Gebre TM, et al. Analysis of cesarean section rates using Robson ten 29 group classification system in a tertiary teaching hospital, Addis Ababa, Ethiopia: a cross-sectional 30 study. BMC Pregnancy Childbirth. 2020;20(1):767. 31 32 6. Tura AK, Pijpers O, de Man M, et al. Analysis of caesarean sections using Robson 10-group 33 classification system in a university hospital in eastern Ethiopia: a cross-sectional study. BMJ Open. 34 2018;8(4):e020520. 35 36 7. Zeitlin J, Durox M, Macfarlane A, et al. Using Robson's Ten-Group Classification System for 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56

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Manual:

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16 **Table 1** Clinical and obstetrics characteristics of the participants (n=3030) 17 Characteristics Number (n) Percentage (%) 18 Age (years) 19 <18 61 2.0 20 >18 <35 2667 88.0 21 22 >35 302 10.0 23 Parity 24 Primiparity 849 28.025 Multiparity (2-4 1266 41.8 26 deliveries) 27 Grand multiparity (≥ 5 915 30.2 28 29 deliveries) 30 Previous CS 410 13.5 31 Gestational age (weeks) 32 698 <37 23.033 77.0 ≥37 2332 34 Onset of labour 35 70.2 Spontaneous 2128 36 37 Induced 90 3.0 38 CS before onset of 26.8 812 39 labour 40 Foetal presentation/lie (single 41 pregnancy) 42 97.2 Cephalic 2884 43 Breech 2.1 63 44 45 19 Transverse/Oblique 0.6 46 Number of fetus 47 Single 2966 97.9 48 2.1 Multiple 64 49 Twins 63 50 Triplet 1 51 52 Mode of delivery 53 Vaginal delivery 1874 61.9 54 Vacuum 162 8.6 55 Ceasarean section 1156 38.2 56 Type of CS 57 Emergency 529 45.8 58 Scheduled 627 54.2 59 60 Foetal outcomes^b

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APGAR 1 minute (mean±	(SD) 7.1±2	2.2				
APGAR 5.minute (mean \pm	$(SD) 8.0\pm 2$	2.4	0.6	4		
Live birth	2983		96.4 12	4		
NICU admission ^c	406		13.0	0		
Sunonun Rirth weight (g) (n-3005)	a IIZ		5.0			
>1000 < 1500	189		61			
>1500 <1500	492		15.0	9		
>2500	2414		78 (0		
N:number, %:percentage, aRate calculated per total r bfoetal outcomes include l The percentage of NICU	NICU: the r number of ba ive births ar admission v	neonatal inter abies born nd stillbirths. vas calculated	nsive care unit, CS: I from live births.	Caesarean se	ction, g:gram	
Fable 2 Distribution of the	e Robson gr	oups with the	eir contributions to	the overall CS	S rate*	
Setting name**: Mogadis	shu Somali [*]	Turkey Traini	ing and Research	Period: Jar	nuary 1, 2022, to .	July 1, 20
Hospital in Somalia		2	-			- /
Group	Number of CS in group	Number of women in group	Group Size ¹ (%)	Group CS rate ² (%)	Absolute group contribution to overall CS	Relative contribu of group overall
			9		rate ³ (%)	rate ⁴ (%
1: Nulliparous, single cephalic, ≥37 weeks, in spontaneous labour	117	477	15.7	24.5	3.9	10.1
2: Nulliparous, single cephalic, \geq 37 weeks, induced or CS before	97	114	3.8	85.1	3.2	8.4
labour						
100001.	7	24	0.9	20.2	0.2	0.6
2a: Labour induced	/	24	0.8	29.2	0.2	0.6
	90	90	3.0	100.0	3.0	7.8
2b: Pre-labour CS				07	2.4	89
2b: Pre-labour CS 3: Multiparous (excluding previous CS), single	103	1188	39.2	8./	5.4	0.7
2b: Pre-labour CS 3: Multiparous (excluding previous CS), single cephalic,≥37 weeks, in spontaneous labour.	103	1188	39.2	8.7	3.4	0.5

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CS before labour.	0	20	0.2	20.0	0.2	0.0
4a: Labour induced	9	30	0.3	30.0	0.3	0.8
4b: Pre-labour CS	92	92	3.7	100.0	3.0	7.9
5: Previous CS, single cephalic, \geq 37 weeks	344	351	11.6	98.0	11.4	29.
6: All nulliparous women with a single preech pregnancy	18	25	0.8	72.0	0.6	1.6
7: All multiparous breeches (including previous CS)	22	38	1.3	57.9	0.7	1.9
8: All multiple pregnancies (including previous CS)	50	64	2.1	78.1	1.7	4.3
9: All women with a single pregnancy with a ransverse or oblique lie, including women with previous CS(s)	19	19	0.6	100.0	0.6	1.6
10: All single cephalic,<37 weeks (including previous CS)	285	632	20.9	45.1	9.4	24.
Total*	1156	3030	100.0%	38.2%	38.2%	100

³⁸ ₃₉ 4 Relative contribution (%) = n of CSs in the group / total N of CSs in the hospital x 100

*67 women were excluded (6 uterine rupture, 1 gunshot-induced CS, 60 incomplete data).
 **Cases for the Robson classification included deliveries with a birth weight>1000 g and gestational age >28 weeks.

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A Cross-Sectional Analysis of Caesarean Sections According to the Robson 10-Group Classification System: The First Report from Somalia

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A Cross-Sectional Analysis of Caesarean Sections According to the Robson 10-Group Classification System: The First Report from Somalia

36 **Background** Caesarean section (CS) is an important indicator of access to and guality of maternal health 37 services. The World Health Organization (WHO) recommends the Robson 10-group classification 38 system as a global standard for assessing, monitoring and comparing CS rates at all levels. Identification 39 of the Robson groups that contribute the most to the overall CS is important to determine possible 40 modifiable factors in our attempts to reduce the CS rate. This study was designed to analyse CS 41 42 deliveries performed in a tertiary referral centre in Somalia according to the Robson 10-group 43 classification system. 44

Design This retrospective study included data on consecutive mothers who had deliveries from January
 1, 2022, to July 1, 2023.

Methods Data were categorised according to the Robson Classification. Each patient's data was coded
 according to Robson's specifications.

Results A total of 3030 deliveries were analysed. Of these 1,156 (38.2 %) were CS. Among the five largest Robson groups, the highest absolute contribution to CSs was found in Group 5 with 11.4 % followed by Group 10 with a corresponding contribution of 9.4%. In the next three largest Robson groups (Group 1, 3, 4), the absolute contributions were 3.9%, 3.4%, and 3.3%, respectively. The total percentages of CSs among all deliveries (n=3030) and among all CSs (n=1156) in the five largest Robson groups were 31.3% and 82.2%, respectively.

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Conclusion Our analysis showed that the overall caesarean section rate was 38.2%, and those major contributors were Robson Group 5 and 10.

Key words: Caesarean section, Robson Classification, Somalia

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This is the first study from Somalia reporting delivery data as concerned with the Robson criteria.
- Foetal viability was defined with higher thresholds for gestational age (≥28 weeks) and birth weight (≥1,000 g).

A Cross-Sectional Analysis of Caesarean Sections According to the Robson 10-Group Classification System: The First Report from Somalia

INTRODUCTION

In 2015 and 2021, the World Health Organization (WHO) proposed adopting the Robson classification system, developed by Michael Robson in 2001, for assessing, monitoring and comparing Caesarean section (CS) rates over time and between different institutions, regions and countries.^{1,2} The Robson system include specific obstetric variables: parity, previous CS, onset of labour, number of foetuses, gestational age, and foetal presentation; hence the 10 Robson groups.³ In 2021 update, although the WHO does not recommend a specific CS rate for countries to achieve at population level, it is emphasized that CS rates up to 10% are highly associated with reductions in maternal and newborn mortality rates. In contrast, CS rates exceeding 10% have been shown to have no benefit in decreased maternal and newborn mortality and may cast doubt on the actual necessity of CSs.¹

In Robson classification, each Robson group represents a cohort of women with similar obstetric characteristics. CS rates higher than given in the Robson system may indicate problems in the management of pregnant women and their deliveries, resulting from obstetric policies, the training and experience of obstetricians, and the education and awareness of pregnant women.⁴

There have been a considerable number of studies aiming to reflect CS rates in individual health

care facilities.⁵⁻⁷ These reports have mainly come from countries with well-established health care

systems, which is not the case for Sub-Saharan African countries and other low-income countries.⁸

This study was designed to analyse CS deliveries performed in a tertiary referral centre in Somalia according to the Robson 10-group classification system.

52 METHODS

54 Study design and participants

This retrospective study evaluated included 3,097 consecutive mothers who had deliveries from January
 1, 2022, to July 1, 2023, at the department of obstetrics of Mogadishu Somali Turkey Training and
 Research Hospital in Mogadishu, the capital city of Somalia. it is a dedicated centre particularly for

high-risk and referred cases. Analysis and reporting of the results are in compliance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.

Data collection

 Data on pregnant women were manually retrieved from admission-to-discharge electronic hospital records and delivery registries by the authors and manually transferred to spreadsheets. Finally, all data and spreadsheets were independently checked by two obstetricians. In addition to maternal age and a detailed inquiry into the past obstetric history of each participant, including parity and previous CS, particular attention was given to delivery-specific information concerning parity (nulliparity or multiparity), onset of labour (spontaneous, induced, or CS before labour), foetal presentation/lie (cephalic, breech, transverse or oblique), number of foetuses (single or multiple), mode of delivery (vaginal or CS), and gestational age (GA) (term or preterm). Neonatal data included stillbirths, APGAR score, birth weight, and the need for admission to the neonatal intensive care unit (NICU).

All women underwent ultrasound examination at admission. Gestational age was calculated from the last menstrual period in combination with obstetric ultrasound examination performed until 20 weeks of pregnancy. In case of unknown last menstrual period or no early ultrasound, GA was estimated based on admission ultrasound examination. In addition to ultrasound examination at admission, birth weights < 2,500 g and \ge 2,500 g were considered in favour of preterm and term deliveries, respectively. In case of inconsistency between ultrasound examination and birth weight, the decision for a term or preterm delivery was based on the birth weight. This strategy has been employed in other studies conducted in similar settings.^{5,9,10}

Inclusion criteria were at least 28 weeks of gestation and a birth weight of at least 1000 g. Women were excluded in the presence of any of the following: uterine rupture, any traumatic wound that could affect delivery, (GA<28 weeks), birth weight (<1,000 g) and incomplete clinical or hospital data.

Patients and public involvement

There was no patient or public involvement in planning or executing this study because of the retrospective study. There are no plans to disperse the results of our research to study participants or the applicable patient community. However, results are being disseminated among the professional communities of Somali and to policymakers, with the intent to inform future health policy decisions.

52 Caesarean Section Rate based on Robson criteria

Data were categorised according to the Robson Classification Report table as designed by seven columns: Column 1 indicating the type of the group; Column 2 number of CS in group; Column 3 Number of women in group; Column 4 Group Size (%); Column 5 Group CS rate (%); Column 6 absolute group contribution to overall CS rate (%) and Column 7 Relative contribution of group to overall CS rate (%). Absolute contribution was defined as the percentage of the number of CSs in each group divided by the total number of women delivered in the hospital during the study period. Relative

 contribution was defined as the percentage of the number of CSs in each group divided by the total number of CSs performed in the hospital during the study period.³

Data processing and analysis

Data were processed using the Statistical Package for Social Sciences (SPSS) version 29 (IBM Corp., Armonk, N.Y.; USA). Continuous data were expressed as means, standard deviation (SD), median, minimum, and maximum, and categorical data as frequencies and percentages. Each patient's data were coded according to the Robson specifications and after computing group variables.

RESULTS

Sociodemographic and obstetric characteristics

During the study period, 3,097 women were admitted for delivery, of whom 3030 were eligible for the analysis. A total of 67 women were excluded from the study. Six mothers had uterine rupture, one mother had gunshot-induced CS. Data from 60 women were incomplete. The characteristics of the participants are summarised in Table 1. The mean age was 26.5±5.6 years (range 15-47). The median parity was 3 (range 1-15). A total of 2,966 single and 64 multiple (63 twins, 1 triplet) deliveries occurred at a mean of 37.7±3.1 weeks (range 28-42). Of 3,030 women, 1,874 (61.9%) had normal vaginal delivery and 1,156 (38.2%) had CS.

The mean birth weight was 2,959±743 grams. A total of 550 women had no early ultrasound examination or could not remember their last menstrual period; therefore, GA was estimated based on ultrasound examination and birth weight or on the latter when there was inconsistency between the two.

During the 18 months of the study, the first five largest patient groups in descending order were seem in Robson groups of 3, 10, 1, 5, and 4. The largest number of deliveries (n=1188, 39.2%) was recorded in Group 3. The next largest number (n=632, 20.9%) was recorded for Group 10, followed by Group 1 with 477 deliveries (15.7%), Group 5 with 351 deliveries (11.6%), and Group 4 with 122 deliveries (4.0%). In these five Robson groups (Group 3, 10, 1, 5, and 4), CS rates were 8.7% (103/1188), 45.1% (285/632), 24.5% (117/477), 98.0% (344/351), and 82.8% (101/122), respectively (Table 2).

Among these five groups, Group 5 had the highest absolute (11.4%) and relative (29.8%) contributions to CSs, followed with corresponding contributions in descending order by 9.4% and 24.7% in Group 10, 3.9% and 10.1% in Group 1, 3.4% and 8.9% in Group 3, and 3.3% and 8.7% in Group 4 (Table 2).

Among all deliveries (n=3030) and among all CSs (n=1156), CSs accounted for 31.3% and 82.2%, respectively, in the five largest Robson groups (Table 2).

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DISCUSSION

Considering the Robson Classification system, with CS rates of considerable sample size (n=3030) and a long period of enrolment (18 months), the current study represents the first comprehensive report from one of the most specialised hospitals in Somalia delivering healthcare to high-risk patients, particularly with services to pregnant women and newborns.

The Robson classification was developed and has been proposed to be used as a tool to monitor and compare CS rates in the same setting over time and between different settings. Given the progressive increase in CS rates worldwide, the WHO considers this trend a major public health concern bringing about potential maternal and perinatal risks, inequity in access and cost issues.³

Our findings show that, during an 18-month period, a total of 3030 women delivered, for which 1156 CSs were performed. Based on the Robson classification, Group 3, which comprised the largest number of women (n=1188, 39.2% of the study population), contributed only 8.5% to the overall rate of CS (relative contribution). In comparison with reports from developed countries¹¹⁻¹³, the size of Group 3 was considerably larger, which is consistent with the social characteristics of Somalia where women have more than one child. However, the relative contribution of Group 3 to CSs was greater than reports from developed countries, mainly because of the hospital's referral status for high-risk pregnancies (severe preeclampsia, vasa previa, and intrauterine growth retardation, etc.). In accordance with the manual on Robson Classification, it would be reasonable to assess Group 3 together with Group 4 because of similarities in the characteristics of the two groups (multiparous, single cephalic, ≥ 37 weeks, and no previous CS) except for the type of labour onset (spontaneous versus induced or CS).³ Despite being the fifth largest group, the size of Group 4 was 4.0%, with a relative contribution to CS of 8.7%. The sum of the two group sizes was 43.2%, which is greater than 30% proposed by the Robson Implementation Manual for countries where women usually have the first child. The Robson Implementation Manual states that for women with more than one child, this sum may exceed 30.0%³, which is just the case for Somali women. Among reproductive women in this cohort, the rate of multiparity was 72%, accounting for the higher rate for the sum of the two groups.

In Group 10, which had the second largest size with 20.9%, the relative contribution of the group was 24.7%. This group size was considerably greater than 5% reported by the manual for normal risk settings, as well as by studies from Germany (12.2%)¹¹ and Ethiopia (15.9%).⁵ This finding has main implications: a fifth of reproductive Somali women have the problem of preterm deliveries which also pose other challenges such as foetal growth restriction or pre-eclampsia and other pregnancy or medical complications. As a corollary, 45.1% of women having these problems underwent CS in this group, accounting for nearly a quarter of all CSs performed in this cohort. This also indicates the crucial

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importance of Turkey Hospital in the capital city of Somalia serving Somali women as a tertiary referral centre with highly dedicated healthcare professionals and a sophisticated obstetric clinic and NICU.

In our analysis, the CS rates in Group 1 and Group 2 were considerably higher at 24.5% and 85.1%, respectively, as compared with the original manual recommendation of 9.8% and 39.9%, respectively, and other reports in the literature.^{5,11-13} This discrepancy mainly resulted from the higher number of women who had been referred to our centre with a diagnosis of severe preeclampsia. This phenomenon is a unique problem to underdeveloped countries like Somalia, where access to prenatal monitoring is extremely restricted because of limited sources and the low level of education. Another feature that distinguishes Somalia from many countries is that pregnant women are free by law to choose CS either before or after initiation of spontaneous labour. These two factors might be influential in making Group 1 the third, and Group 2 the sixth significant contributors to the overall CS rate.

In Group 5, we found the second highest CS rate at 98.0% following Group 9 (100.0%). This is reasonable because this group involves pregnancies following previous CS where subsequent CS is almost inevitable. There appears to be two ways to decrease the CS rate in this group. As the necessity for CS primarily arises from a previous CS, the CS rate in Group 5 cannot be reduced unless CS rates are lowered in the preceding groups. Second, the routine practise in obstetrics unfortunately is adopting a CS strategy following a previous CS, despite the presence of a universal consensus about the safety of and thus the necessity for a subsequent vaginal delivery in eligible women following a single previous lower segment CS. Therefore, attempting vaginal delivery in this setting would decrease the CS rate in Group 5.

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Considering the steps recommended by the Robson classification to assess type of population, we derived the following conclusions: For step 1, the sum of Group 1 and Group 2 was 591, yielding a percentage of 19.5%, being considerably lower than the ideal percentage of 38.1%. This discrepancy arises from the unique characteristics of Somalia and other low- and middle-income countries where most of the population is represented by multiparous women, reducing the total size of Group1 and Group 2. Therefore, higher percentages reported from some African countries with similar characteristics to those of Somalia may cast doubt about their reliability.^{14,15} Our finding was consistent with a report from Eastern Ethiopia.¹⁶ For step 2, the sum of Group 3 and Group 4 (n=1310) corresponded to 43.2%. The proportion of multiparous women in Somalia now exerts a positive effect on this result. Group sizes for this step do not differ much across African countries.¹⁴⁻¹⁶ As for the step 3, the proportion of the size of Group 5 to the total CS rate was 30%, indicating a higher total CS rate in Somalia. The reported rates are 35.2% and 32.8 for Tanzania¹⁵ and Ethiopia¹⁶, respectively.

One limitation to this study is that we defined foetal viability with higher thresholds for gestational age (\geq 28 weeks) and birth weight (\geq 1,000 grams) as compared with those reported for developed countries. In the presence of a gestational age of less than 28 weeks and a birth weight of less than 1,000 grams, the likelihood of a newborn to survive is considerably low due to limited healthcare settings in Somalia.

¹² CONCLUSIONS

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Our analysis identified the contribution of each group to the caesarean section (CS) rate in each 14 15 category of the Robson classification system in a tertiary healthcare centre in Somalia. The overall CS 16 rate was 38.2%, and those major contributors were Robson Group 5 and 10. This study also revealed 17 the next largest contributor to the CS rate among low-risk groups (Robson 1, 3, and 4). These target 18 groups require more in-depth analysis to identify possible modifiable factors and to apply specific 19 interventions to reduce the CS rate. To improve maternity care practices, it is recommended that the 20 federal and regional ministries of health prioritize the implementation of Robson's 10-group 21 22 classification system as an audit tool in all hospitals in Somalia. This would enable monitoring of the 23 caesarean delivery rate, facilitate comparisons, and allow for the identification and revision of practice 24 gaps in each hospital. The classification will also let us implement strategies to reduce the frequency 25 of medically unnecessary primary CS. 26

Ethics approval and consent to participate

The study was approved by the Mogadishu Somali Turkey Training and Research Hospital Institutional Review Board (IRB) (Permission number: MSTH/15148/22.08.2023/827). Obtaining inform consent was waived by the IRB due to the retrospective design of the study. The study was performed in accordance with the principles and guidelines of the Declaration of Helsinki.

3637 Consent for publication

³⁸₃₉ Not applicable.

40 Availability of data and materials

All data generated or analysed during this study are included in this article. The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. The corresponding author (email: dradilbarut@gmail.com) can be contacted for the data with a reasonable request.

48 **Conflict of interest**

The authors declare that they have no competing interests. 49

51 **Funding**

53 This study has not received any funding.

54 55 Authors' contributions

AB: conceptualisation, manuscript writing, manuscript editing and review, data collection and data analysis. HBH: manuscript writing, manuscript editing and review, and data analysis. UE: manuscript editing and review and data collection. AB acted as the guarantor for this study and accepts full and review and accepts full

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responsibility for the finished work and the conduct of the study, had access to the data and controlled the decision to publish.

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10 11 **Abbreviations**

CS: Caesarean section, WHO: The World Health Organization, NICU: the neonatal intensive care unit,
 SPSS: Statistical package for social science; SD: standard deviation; STROBE: Strengthening the
 Reporting of Observational Studies in Epidemiology; USA: United States of America; IBM:
 International Business Machines.

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5 6 7 8 9 data. J Obstet Gynaecol Res. 2021;47(6):2099-2109. 10 11 12 13 14 in eastern Ethiopia? A cross-sectional study. BMJ Open. 2021;11(8):e047206. 15 16 17 18 19 20 observational retrospective study. BMJ Open. 2019;9(12):e033348. 21 22 23 24 25 2020;10(10):e039098. 26 27 28 29 30 **Table 1** Clinical and obstetrics characteristics of the participants (n=3030) 31 32 Characteristics Number (n) Percentage (%) 33 Age (years) 34 61 <18 2.0 35 2.667 ≥18 <35 88.0 36 302 10.0 >35 37 Parity 38 39 Primiparity 849 28.0 40 41.8 Multiparity (2-4 1,266 41 deliveries) 42 Grand multiparity (≥ 5 915 30.2 43 deliveries) 44 Previous CS 410 13.5 45 Gestational age (weeks) 46 47 698 <37 23.0 48 >37 2,332 77.0 49 Onset of labour 50 Spontaneous 2,145 68.6 51 Induced 2.4 73 52

CS before onset of

Foetal presentation/lie (single

Transverse/Oblique

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labour

pregnancy)

Cephalic

Breech

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2.884

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15.4

97.2

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Number of fetus						
Single	2.966		97.9			
Multiple	64		2.1			
Twins	63					
Triplet	1					
Mode of delivery						
Vaginal delivery	1,874		61.9	1		
Vacuum	162		8.6			
Caesarean section	1,156		38.2			
Type of CS	-					
Emergency	529		45.8			
Scheduled	627		54.2			
Foetal outcomes ^b						
APGAR 1.minute (mean:	±SD) 7.1±2	.2				
APGAR 5.minute (mean:	±SD) 8.0±2	.4				
Live birth	2,983		96.4			
NICU admission ^c	406		13.6			
Stillbirth	112		3.6			
Birth weight (g) (n=3095	j)a					
>1000 <1500	189		6.1			
- >1500 <2500	492		15.9	1		
- >2500	2 4 1 4		78.0	1		
Table 2 Distribution of th	ne Robson gro	ups with thei	r contributions to t	he overall CS	S rate*	
	C	1				
Setting**: Mogadishu Som Somalia	nali Turkey Tra	ining and Rese	earch Hospital in	Period: Jan	uary 1, 2022, to Ju	ly 1, 2023
Group	Number of	Number of	Group Size ¹ (%)	Group CS	Absolute group	
	group	group		rate ² (%)	contribution to overall CS rate ³ (%)	Relative contribut of group overall C rate ⁴ (%)
1: Nulliparous, single cephalic, ≥37 weeks, in spontaneous labour	group	477	15.7	rate ² (%) 24.5	contribution to overall CS rate ³ (%) 3.9	Relative contribut of group overall C rate ⁴ (%) 10.1

Total*	1156	3030	100.0%	38.2%	38.2%	100%
previous CS)						
<37 weeks (including						
10: All single cephalic,	285	632	20.9	45.1	9.4	24.7
pregnancy with a transverse or oblique lie, including women with previous CS(s)						
pregnancies (including previous CS) 9: All women with a single	19	19	0.6	100.0	0.6	1.6
previous CS) 8: All multiple	50	64	2.1	78.1	1.7	4.3
7: All multiparous	22	38	1.3	57.9	0.7	1.9
cephalic, ≥ 37 weeks 6: All nulliparous women with a single breech pregnancy	18	25	0.8	72.0	0.6	1.6
5: Previous CS, single	344	351	11.6	98.0	11.4	29.8
4b: Pre-labour CS	92	92	3.7	100.0	3.0	7.9
4a: Labour induced	9	30	0.3	30.0	0.3	0.8
labour.						
induced or CS before						
previous CS), single						
4: Multiparous (excluding	101	122	4.0	82.8	3.3	8.7
previous CS), single cephalic, 237 weeks, in						
3: Multiparous (excluding	103	1,188	39.2	8.7	3.4	8.9
2b: Pre-labour CS	90	90	3.0	100.0	3.0	7.8
2a. Labour induced	7	24	0.8	29.2	0.2	0.6

⁴Relative contribution (%) = n of CSs in the group / total N of CSs in the hospital x 100 54

55 *67 women were excluded (6 uterine rupture, 1 gunshot-induced CS, 60 incomplete data).

56 **Cases for the Robson classification included deliveries with a birth weight>1000 g and gestational age >28 weeks.

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A Cross-Sectional Analysis of Caesarean Sections According to the Robson 10-Group Classification System in Somalia

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34	A Cross-Sectional Analysis of Caesarean Sections According to the Robson 10-Group						
35 36	Classification System in Somalia						
37 38							
 39 40 41 42 43 44 45 46 47 	Background Caesarean section (CS) is an important indicator of access to and quality of maternal health services. The World Health Organization (WHO) recommends the Robson 10-group classification system as a global standard for assessing, monitoring and comparing CS rates at all levels. Identification of the Robson groups that contribute the most to the overall CS is important to determine possible modifiable factors in our attempts to reduce the CS rate. This study was designed to analyse CS deliveries performed in a tertiary referral centre in Somalia according to the Robson 10-group classification system.						
47 48 49	Design This retrospective study included data on consecutive mothers who had deliveries from January 1, 2022, to July 1, 2023.						
50 51 52 53	Methods Data were categorised according to the Robson Classification. Each patient's data was coded according to Robson's specifications.						
54 55 56 57 58 59 60	Results A total of 3030 deliveries were analysed. Of these 1,156 (38.2 %) were CS. Among the five largest Robson groups, the highest absolute contribution to CSs was found in Group 5 with 11.4 % followed by Group 10 with a corresponding contribution of 9.4%. In the next three largest Robson groups (Group 1, 3, 4), the absolute contributions were 3.9%, 3.4%, and 3.3%, respectively. The total percentages of CSs among all deliveries (n=3030) and among all CSs (n=1156) in the five largest Robson groups were 31.3% and 82.2%, respectively.						

Conclusion Our analysis showed that the overall caesarean section rate was 38.2%, and those major contributors were Robson Group 5 and 10.

Key words: Caesarean section, Robson Classification, Somalia

STRENGTHS AND LIMITATIONS OF THIS STUDY

- The combination of two different periods of 2022 and 2023 enlarged the sample size and allowed us to avoid seasonal bias.
- A single-hospital study might be less generalisable, but our conclusions are relevant and applicable in other contexts.
- The main limitation of our study was its retrospective nature.
- The second main limitation of our study is that the foetal viability cut-off value in Somalia is higher than the gestational age thresholds (≥28 weeks) reported in developed countries.

A Cross-Sectional Analysis of Caesarean Sections According to the Robson 10-Group Classification System in Somalia

³⁴₃₅ INTRODUCTION

In 2015 and 2021, the World Health Organization (WHO) proposed adopting the Robson classification system, developed by Michael Robson in 2001, for assessing, monitoring and comparing Caesarean section (CS) rates over time and between different institutions, regions and countries.^{1,2} The Robson system include specific obstetric variables: parity, previous CS, onset of labour, number of foetuses, gestational age, and foetal presentation; hence the 10 Robson groups.³ In 2021 update, although the WHO does not recommend a specific CS rate for countries to achieve at population level, it is emphasized that CS rates up to 10% are highly associated with reductions in maternal and newborn mortality rates. In contrast, CS rates exceeding 10% have been shown to have no benefit in decreased maternal and newborn mortality and may cast doubt on the actual necessity of CSs.¹

In Robson classification, each Robson group represents a cohort of women with similar obstetric
 characteristics. CS rates higher than given in the Robson system may indicate problems in the
 management of pregnant women and their deliveries, resulting from obstetric policies, the training and
 experience of obstetricians, and the education and awareness of pregnant women.⁴

There have been a considerable number of studies aiming to reflect CS rates in individual health care facilities.⁵⁻⁷ These reports have mainly come from countries with well-established health care systems, which is not the case for Sub-Saharan African countries and other low-income countries.⁸

This study was designed to analyse CS deliveries performed in a tertiary referral centre in
 Somalia according to the Robson 10-group classification system.

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METHODS

Study design and participants

This retrospective study evaluated included 3,097 consecutive mothers who had deliveries from January 1, 2022, to July 1, 2023, at the department of obstetrics of Mogadishu Somali Turkey Training and Research Hospital in Mogadishu, the capital city of Somalia. it is a dedicated centre particularly for high-risk and referred cases. Analysis and reporting of the results are in compliance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) checklist.

Data collection

Data on pregnant women were manually retrieved from admission-to-discharge electronic hospital records and delivery registries by the authors and manually transferred to spreadsheets. Finally, all data and spreadsheets were independently checked by two obstetricians. In addition to maternal age and a detailed inquiry into the past obstetric history of each participant, including parity and previous CS, particular attention was given to delivery-specific information concerning parity (nulliparity or multiparity), onset of labour (spontaneous, induced, or CS before labour), foetal presentation/lie (cephalic, breech, transverse or oblique), number of foetuses (single or multiple), mode of delivery (vaginal or CS), and gestational age (GA) (term or preterm). Neonatal data included stillbirths, APGAR score, birth weight, and the need for admission to the neonatal intensive care unit (NICU).

All women underwent ultrasound examination at admission. Gestational age was calculated from the last menstrual period in combination with obstetric ultrasound examination performed until 20 weeks of pregnancy. In case of unknown last menstrual period or no early ultrasound, GA was estimated based on admission ultrasound examination. In addition to ultrasound examination at admission, birth weights < 2,500 g and \ge 2,500 g were considered in favour of preterm and term deliveries, respectively. In case of inconsistency between ultrasound examination and birth weight, the decision for a term or preterm delivery was based on the birth weight. This strategy has been employed in other studies conducted in similar settings.^{5,9,10}

Inclusion criteria were at least 28 weeks of gestation and a birth weight of at least 1000 g. Women were excluded in the presence of any of the following: uterine rupture, any traumatic wound that could affect delivery, (GA<28 weeks), birth weight (<1,000 g) and incomplete clinical or hospital data.

Patients and public involvement

There was no patient or public involvement in planning or executing this study because of the retrospective study. There are no plans to disperse the results of our research to study participants or the applicable patient community. However, results are being disseminated among the professional communities of Somali and to policymakers, with the intent to inform future health policy decisions.

Caesarean Section Rate based on Robson criteria

Data were categorised according to the Robson Classification Report table as designed by seven columns: Column 1 indicating the type of the group; Column 2 number of CS in group; Column 3 Number of women in group; Column 4 Group Size (%); Column 5 Group CS rate (%); Column 6 absolute group contribution to overall CS rate (%) and Column 7 Relative contribution of group to overall CS rate (%). Absolute contribution was defined as the percentage of the number of CSs in each group divided by the total number of women delivered in the hospital during the study period. Relative contribution was defined as the percentage of the number of CSs in each group divided by the total number of the number of CSs in each group divided by the total number of the number of CSs in each group divided by the total number of the number of CSs in each group divided by the total number of the number of CSs in each group divided by the total number of the number of CSs in each group divided by the total number of the number of CSs in each group divided by the total number of the number of CSs in each group divided by the total number of the number of CSs in each group divided by the total number of CSs in each group divided by the total number of CSs in each group divided by the total number of CSs in each group divided by the total number of CSs in each group divided by the total number of CSs in each group divided by the total number of CSs in each group divided by the total number of CSs in each group divided by the total number of CSs in each group divided by the total number of CSs performed in the hospital during the study period.³

B Data processing and analysis

Data were processed using the Statistical Package for Social Sciences (SPSS) version 29 (IBM Corp., Armonk, N.Y.; USA). Continuous data were expressed as means, standard deviation (SD), median, minimum, and maximum, and categorical data as frequencies and percentages. Each patient's data were coded according to the Robson specifications and after computing group variables.

RESULTS

Sociodemographic and obstetric characteristics

During the study period, 3,097 women were admitted for delivery, of whom 3030 were eligible for the analysis. A total of 67 women were excluded from the study. Six mothers had uterine rupture, one mother had gunshot-induced CS. Data from 60 women were incomplete. The characteristics of the participants are summarised in Table 1. The mean age was 26.5 ± 5.6 years (range 15-47). The median parity was 3 (range 1-15). A total of 2,966 single and 64 multiple (63 twins, 1 triplet) deliveries occurred at a mean of 37.7 ± 3.1 weeks (range 28-42). Of 3,030 women, 1,874 (61.9%) had normal vaginal delivery and 1,156 (38.2%) had CS.

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The mean birth weight was 2,959±743 grams. A total of 550 women had no early ultrasound examination or could not remember their last menstrual period; therefore, GA was estimated based on ultrasound examination and birth weight or on the latter when there was inconsistency between the two.

During the 18 months of the study, the first five largest patient groups in descending order were seem in Robson groups of 3, 10, 1, 5, and 4. The largest number of deliveries (n=1188, 39.2%) was recorded in Group 3. The next largest number (n=632, 20.9%) was recorded for Group 10, followed by Group 1 with 477 deliveries (15.7%), Group 5 with 351 deliveries (11.6%), and Group 4 with 122 deliveries (4.0%). In these five Robson groups (Group 3, 10, 1, 5, and 4), CS rates were 8.7% (103/1188), 45.1% (285/632), 24.5% (117/477), 98.0% (344/351), and 82.8% (101/122), respectively (Table 2).

Among these five groups, Group 5 had the highest absolute (11.4%) and relative (29.8%) contributions to CSs, followed with corresponding contributions in descending order by 9.4% and

24.7% in Group 10, 3.9% and 10.1% in Group 1, 3.4% and 8.9% in Group 3, and 3.3% and 8.7% in Group 4 (Table 2).

Among all deliveries (n=3030) and among all CSs (n=1156), CSs accounted for 31.3% and 82.2%, respectively, in the five largest Robson groups (Table 2).

DISCUSSION

 Considering the Robson Classification system, with CS rates of considerable sample size (n=3030) and a long period of enrolment (18 months), the current study represents the first comprehensive report from one of the most specialised hospitals in Somalia delivering healthcare to high-risk patients, particularly with services to pregnant women and newborns.

The Robson classification was developed and has been proposed to be used as a tool to monitor and compare CS rates in the same setting over time and between different settings. Given the progressive increase in CS rates worldwide, the WHO considers this trend a major public health concern bringing about potential maternal and perinatal risks, inequity in access and cost issues.³

Our findings show that, during an 18-month period, a total of 3030 women delivered, for which 1156 CSs were performed. Based on the Robson classification, Group 3, which comprised the largest number of women (n=1188, 39.2% of the study population), contributed only 8.5% to the overall rate of CS (relative contribution). In comparison with reports from developed countries¹¹⁻¹³, the size of Group 3 was considerably larger, which is consistent with the social characteristics of Somalia where women have more than one child. However, the relative contribution of Group 3 to CSs was greater than reports from developed countries, mainly because of the hospital's referral status for high-risk pregnancies (severe preeclampsia, vasa previa, and intrauterine growth retardation, etc.). In accordance with the manual on Robson Classification, it would be reasonable to assess Group 3 together with Group 4 because of similarities in the characteristics of the two groups (multiparous, single cephalic, ≥ 37) weeks, and no previous CS) except for the type of labour onset (spontaneous versus induced or CS).³ Despite being the fifth largest group, the size of Group 4 was 4.0%, with a relative contribution to CS of 8.7%. The sum of the two group sizes was 43.2%, which is greater than 30% proposed by the Robson Implementation Manual for countries where women usually have the first child. The Robson Implementation Manual states that for women with more than one child, this sum may exceed $30.0\%^3$, which is just the case for Somali women. Among reproductive women in this cohort, the rate of multiparity was 72%, accounting for the higher rate for the sum of the two groups.

In Group 10, which had the second largest size with 20.9%, the relative contribution of the group was 24.7%. This group size was considerably greater than 5% reported by the manual for normal risk

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settings, as well as by studies from Germany (12.2%)¹¹ and Ethiopia (15.9%).⁵ This finding has main implications: a fifth of reproductive Somali women have the problem of preterm deliveries which also pose other challenges such as foetal growth restriction or pre-eclampsia and other pregnancy or medical complications. As a corollary, 45.1% of women having these problems underwent CS in this group, accounting for nearly a quarter of all CSs performed in this cohort. This also indicates the crucial importance of Turkey Hospital in the capital city of Somalia serving Somali women as a tertiary referral centre with highly dedicated healthcare professionals and a sophisticated obstetric clinic and NICU.

In our analysis, the CS rates in Group 1 and Group 2 were considerably higher at 24.5% and 85.1%, respectively, as compared with the original manual recommendation of 9.8% and 39.9%, respectively, and other reports in the literature.^{5,11-13} This discrepancy mainly resulted from the higher number of women who had been referred to our centre with a diagnosis of severe preeclampsia. This phenomenon is a unique problem to underdeveloped countries like Somalia, where access to prenatal monitoring is extremely restricted because of limited sources and the low level of education. Another feature that distinguishes Somalia from many countries is that pregnant women are free by law to choose CS either before or after initiation of spontaneous labour. These two factors might be influential in making Group 1 the third, and Group 2 the sixth significant contributors to the overall CS rate.

In Group 5, we found the second highest CS rate at 98.0% following Group 9 (100.0%). This is reasonable because this group involves pregnancies following previous CS where subsequent CS is almost inevitable. There appears to be two ways to decrease the CS rate in this group. As the necessity for CS primarily arises from a previous CS, the CS rate in Group 5 cannot be reduced unless CS rates are lowered in the preceding groups. Second, the routine practise in obstetrics unfortunately is adopting a CS strategy following a previous CS, despite the presence of a universal consensus about the safety of and thus the necessity for a subsequent vaginal delivery in eligible women following a single previous lower segment CS. Therefore, attempting vaginal delivery in this setting would decrease the CS rate in Group 5.

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Considering the steps recommended by the Robson classification to assess type of population, we derived the following conclusions: For step 1, the sum of Group 1 and Group 2 was 591, yielding a percentage of 19.5%, being considerably lower than the ideal percentage of 38.1%. This discrepancy arises from the unique characteristics of Somalia and other low- and middle-income countries where most of the population is represented by multiparous women, reducing the total size of Group1 and Group 2. Therefore, higher percentages reported from some African countries with similar characteristics to those of Somalia may cast doubt about their reliability.^{14,15} Our finding was consistent with a report from Eastern Ethiopia.¹⁶ For step 2, the sum of Group 3 and Group 4 (n=1310) corresponded to 43.2%. The proportion of multiparous women in Somalia now exerts a positive effect on this result. Group sizes for this step do not differ much across African countries.¹⁴⁻¹⁶ As for the step 3, the proportion of the size of Group 5 to the total CS rate was 30%, indicating a higher total CS rate in Somalia. The reported rates are 35.2% and 32.8 for Tanzania¹⁵ and Ethiopia¹⁶, respectively.

One limitation to this study is that we defined foetal viability with higher thresholds for gestational age (\geq 28 weeks) and birth weight (\geq 1,000 grams) as compared with those reported for developed countries. In the presence of a gestational age of less than 28 weeks and a birth weight of less than 1,000 grams, the likelihood of a newborn to survive is considerably low due to limited healthcare settings in Somalia.

CONCLUSIONS

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Our analysis identified the contribution of each group to the caesarean section (CS) rate in each 22 category of the Robson classification system in a tertiary healthcare centre in Somalia. The overall CS 23 rate was 38.2%; those major contributors were Robson Group 5 and 10. This study also revealed the 24 next three largest contributors to the CS rate among low-risk groups (Robson 1, 3, and 4). A detailed 25 analysis of target groups is essential to identify modifiable factors and implement interventions to 26 27 reduce CS rates. Health authorities should adopt Robson's 10-Group Classification System as a 28 standardized audit tool in all Somali hospitals. This may enable CS rate monitoring, inter-hospital 29 comparisons, and the identification of practice gaps while supporting strategies to reduce unnecessary 30 CS. 31

Ethics approval and consent to participate

The study was approved by the Mogadishu Somali Turkey Training and Research Hospital Institutional Review Board (IRB) (Permission number: MSTH/15148/22.08.2023/827). Obtaining inform consent was waived by the IRB due to the retrospective design of the study. The study was performed in accordance with the principles and guidelines of the Declaration of Helsinki.

40 41 **Consent for publication**

 $^{42}_{43}$ Not applicable.

44 Availability of data and materials

All data generated or analysed during this study are included in this article. The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request, but restrictions apply to the availability of these data, which were used under license for the current study, and so are not publicly available. The corresponding author (email: dradilbarut@gmail.com) can be contacted for the data with a reasonable request.

52 Conflict of interest

 $_{54}^{53}$ The authors declare that they have no competing interests.

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57 This study has not received any funding.

58 59 Authors' contributions

> 21 22

AB: conceptualisation, manuscript writing, manuscript editing and review, data collection and data analysis. HBH: manuscript writing, manuscript editing and review, and data analysis. UE: manuscript editing and review and data collection. AB acted as the guarantor for this study and accepts full responsibility for the finished work and the conduct of the study, had access to the data and controlled the decision to publish.

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14 Abbreviations

CS: Caesarean section, WHO: The World Health Organization, NICU: the neonatal intensive care unit,
 SPSS: Statistical package for social science; SD: standard deviation; STROBE: Strengthening the
 Reporting of Observational Studies in Epidemiology; USA: United States of America; IBM:
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haracteristics	Number (n)	Percentage (%)
.ge (years)		4
<18	61	2.0
≥18 <35	2,667	88.0
≥35	302	10.0
Parity		
Primiparity	849	28.0
Multiparity (2-4	1,266	41.8
deliveries)		
Grand multiparity (≥ 5	915	30.2
deliveries)		
Previous CS	410	13.5
Gestational age (weeks)		
<37	698	23.0
<u>≥</u> 37	2,332	77.0
Onset of labour		
Spontaneous	2,145	68.6
Induced	73	2.4
CS before onset of	812	15.4
abour		
Foetal presentation/lie (single		
nrognonov)		

1: Nulliparous, single	group 117	477	15.7	24.5	3.9	overall (%
Group	group				rate ³ (%)	overall (%
VIIOIID	CS in	women in group	Group Size ¹ (%)	rate ² (%)	contribution to overall CS	contribu of group
Somalia Group	Number of	Number of		Group CS	Absolute group	Relativa
Setting**: Mogadishu Son	nali Turkey Tra	ining and Res	earch Hospital in	Period: Jan	uary 1, 2022, to Jul	y 1, 2023
Table 2 Distribution of the	e Robson grou	ups with thei	r contributions to th	he overall CS	s rate*	
The percentage of NICO add	iissioii was calcu					
^b foetal outcomes include live ^c The percentage of NICU adm	births and stillbir	ths. lated from live	births			
g:gram aRate calculated per total num	ber of babies bor	n				
<u>≥</u> 2500 N:number, %:percentage, SD	2,414 standard deviati	on, NICU: the	/8.0/ neonatal intensive care	unit, CS: Caes	arean section,	
≥1500 <2500 >2500	492		15.9			
≥1000 <1500	189		6.1			
Birth weight (g) (n=3095	5) ^a		5.0			
Stillbirth	112		3.6			
NICU admission	2,983 206		90.4 13 6			
APGAR 5.minute (mean	\pm SD) 8.0 \pm 2	.4	06 /			
APGAR 1.minute (mean	\pm SD) 7.1 \pm 2	.2				
Foetal outcomes ^b		2				
Scheduled	627		54.2			
Emergency	529		45.8			
Type of CS						
Caesarean section	1,156		38.2			
Vacuum	162		8.6			
Vaginal deliverv	1 874		61 9			
Mode of delivery	1					
1 wills Trinlet	1					
Twing	04 62		2.1			
Single Multiple	2,966		9/.9 2 1			
Number of fetus	2.066		07.0			
NT 1 CC4	e 19		0.6			
Transverse/Oblique	63		2.1			
Breech Transverse/Oblique)1.2			

Total*	1156	3030	100.0%	38.2%	38.2%	100%
vrevious CS)						
0: All single cephalic,	285	632	20.9	45.1	9.4	24.7
ransverse or oblique lie, ncluding women with previous CS(s)						
pregnancies (including previous CS) 9: All women with a single	19	19	0.6	100.0	0.6	1.6
previous CS) 8: All multiple	50	64	2.1	78.1	1.7	4.3
breeches (including		30	1.5	51.7	0.7	1.7
with a single breech bregnancy 7. All multiparous	18	25	0.8	72.0	0.6	1.6
cephalic, ≥ 37 weeks • All nulliparous women	10	25		72.0	0.6	1.6
5: Previous CS, single	344	351	11.6	98.0	11.4	29.8
4b: Pre-labour CS	92	92	3.7	100.0	3.0	7.9
4a: Labour induced	9	30	0.3	30.0	0.3	0.8
Induced or CS before						
cepnalic, >3 / weeks,						
previous CS), single						
4: Multiparous (excluding	101	122	4.0	82.8	3.3	8.7
previous CS), single cephalic,≥37 weeks, in spontaneous labour						
3: Multiparous (excluding	103	1,188	39.2	8.7	3.4	8.9
2b: Pre-labour CS	90	90	3.0	100.0	3.0	7.8
2a: Labour induced	7	24	0.8	29.2	0.2	0.6
cephalic, ≥37 weeks, induced or CS before labour.						
2: Nulliparous, single	97	114	3.8	85.1	3.2	8.4

CS: Caesarean section
*These totals and percentages come from the data in the table. ¹Group size (%) = n of women in the group / total N women
delivered in the hospital x 100

⁵⁴ ²Group CS rate (%) = n of CSs in the group / total N of women in the group x 100

⁵⁵ ³Absolute contribution (%) = n of CSs in the group / total N of women delivered in the hospital x 100

⁵⁶ 4 Relative contribution (%) = n of CSs in the group / total N of CSs in the hospital x 100 ⁵⁷

*67 women were excluded (6 uterine rupture, 1 gunshot-induced CS, 60 incomplete data).

⁵⁹ **Cases for the Robson classification included deliveries with a birth weight>1000 g and gestational age >28 weeks.

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