كليـــــــة الـطب
والصيدلة - مراكش
FACULTÉ DE MÉDECINE
ET DE PHARMACIE - MARRAKECH

MARRAKECH
جامعة القاضي عياض
UNIVERSITÉ CADI AYYAD

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Perception of faculty members about undergraduate medical research

THESIS

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By

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Born on March the 29th 1997 in TIZNIT

TO OBTAIN THE DEGREE OF DOCTOR OF MEDICINE

KEYWORDS

Faculty members-Undergraduate medical research- Undergraduate medical students-Perception-Faculty of Medicine and Pharmacy of Marrakesh

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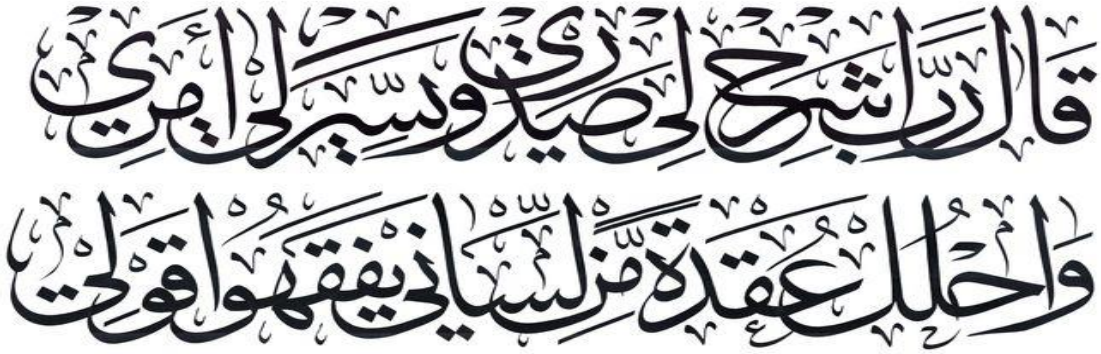
Mrs.	M. SEBBANI Professor of Community Medicine	JUDGE


بسم الله الرحمن الرحيم


قال رب اشرح لي صدري ويسر لي أمري
واحلل عقدة من لساني يفقهوا قولي


صدق الله العظيم

Hippocratic Oath

At this time of being admitted as a member of the medical profession,

I solemnly pledge myself to consecrate my life to the service of humanity;

I will give to my teachers the respect and gratitude which is their due;

I will practice my profession with conscience and dignity;

The health of my patients will be my first consideration;

I will respect the secrets which are confined in me;

I will maintain by all means in my power, the honor and noble traditions of the medical profession;

My colleagues will be my brothers and sisters;

I will not permit consideration of religion, nationality, race, gender, politics, socioeconomic standing or sexual orientation intervene between my duty and my patient;

I will maintain the utmost respect for human life;

Even under threat, I will not use my medical knowledge contrary to laws of humanity;

I make these promises solemnly, freely and upon my honor.

Declaration of Genève, 1948.

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129	CHRAA Mohamed	P.E.S	Physiologie
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151	SEDDIKI Rachid	Pr Ag	Anesthésie-réanimation
152	SEBBANI Majda	Pr Ag	Médecine Communautaire (Médecine préventive, santé publique et hygiene)
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154	HAMMOUNE Nabil	Pr Ag	Radiologie
155	ESSADI Ismail	Pr Ag	Oncologie médicale
156	ALJALIL Abdelfattah	Pr Ag	Oto-rhino-laryngologie

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158	RHARRASSI Issam	Pr Ag	Anatomie-patologique
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317	RAITEB Mohammed	MC	Maladies infectieuses
318	DREF Maria	MC	Anatomie pathologique
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321	JENDOUZI Omar	MC	Urologie
322	MANSOURI Maria	MC	Génétique
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332	IJDDA Sara	MC	Endocrinologie et maladies métaboliques
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336	HENDY Iliass	MC	Cardiologie
337	MOURAFIQ Omar	MC	Traumato-orthopédie
338	ZAIZI Abderrahim	MC	Traumato-orthopédie
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347	IBBA Mouhsin	MC	Chirurgie thoracique
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349	SAADOUNE Mohamed	MC	Radiothérapie
350	TLEMCANI Younes	MC	Ophtalmologie
351	SOLEH Abdelwahed	MC	Traumato-orthopédie
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353	BERGHALOUT Mohamed	MC	Psychiatrie
354	EL BARAKA Soumaya	MC	Chimie analytique-bromatologie
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360	BOUCHKARA Wafae	MC	Gynécologie-obstétrique
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LISTE ARRETEE LE 03/02/2025

DEDICATIONS

« Soyons reconnaissants aux personnes qui nous donnent du bonheur ; elles sont les charmants jardiniers par qui nos âmes sont fleuries »

Marcel Proust

Je dois avouer pleinement ma reconnaissance à toutes les personnes qui m'ont soutenue durant mon parcours, qui ont su me hisser vers le haut pour atteindre mon objectif. C'est avec grand amour, respect et gratitude que je dédie ce modeste travail comme preuve de respect et de reconnaissance

C'est avec amour, respect et gratitude que je dédie cette thèse à . . .

À Allah

Le tout puissant, clément et miséricordieux qui a illuminé ma voie, qui m'a inspiré et guidé dans le bon chemin, qui a facilité mes épreuves, qui a apaisé mon âme aux moments les plus difficiles, qui m'a permis de voir ce jour tant attendu, je te dois ce que je suis devenue. Je te remercie et je te prie de m'aider à accomplir mon métier de médecin avec conscience et dignité.

"الْحَمْدُ لِلَّهِ الَّذِي بِنِعْمَتِهِ تَتِمُّ الصَّالِحَاتُ"

To my beloved parents,

Words will never be enough to express my deepest gratitude for all what you have done for me. This journey through medical school has been as challenging as it has been rewarding, and I would not have reached this point without your unconditional love, patience, and support.

Thank you for being the pillars of my strength. For all the sleepless nights you spent worrying about me, for every encouraging word when I doubted myself, and for the countless sacrifices you made to help me pursue my dream, I am forever indebted to you.

To my Mom,

Whenever I hear her name and whenever I feel her embrace,
I get teary.
To the person who loved me, loves me and will always love me.
To the person who loved me unconditionally,
and I still learn a lot from her
and she learns a lot from our journey together, how to love each other unconditionally,
to the person who Allah made her my mom because only God knows what hardship I've been through
and she was my refuge,
she embraced all my forms, with unlimited patience and love.
to the person who I will always be grateful to,
to the person who never fails to stand by my side,
who sheds tears of sorrow and empathy silently when I struggle through life and my medical studies.
but also tears of joy and pride when I'm finally finding my road.
To the person I love most.
My dear mom.
To the person who encouraged me to take bold steps,
to the person who is behind my today identity.
To the person who never doubted my ability and my existence,
who never doubted I could make it happen,
to the person who was confident I would make it, while doubting myself, to the person who always pushed me to be the best version of my life.
To the person, I'm still discovering and finding how lovely she is.
To the person who never complained about my repeating stories over and over.
Who gets excited whenever I share a story about my college life.
To the person who stood by my side,
in my sickness,
my success, and my confidence era.
who called me whenever it felt distant.
To the person, to whom I'll testify to GOD to be the best parent ever.
I love you, Mom,
with all my cells.

إلى من اختارها الله لي أما،

إلى تلك الروح التي أحبتني بكل جوارحها و حضنتني منذ اللحظة الأولى.

أحبتني، و لازالت تحبني حبا أبديا،

إلى الروح التي لا يفوح منها إلا الفضل و الكرم.

إلى من منحتني حبا لا مشروطا،

ضمتني إلى حضنها الدافئ عندما قست الحياة علي .

علمتني كيف احب.

رحلتنا معا علمتنا كيف نمنح بعضا البعض هذا الحب النقي،

لا و لن تكفيني هته الكلمات لأوف ما قدمته لي من تضحيات ،

كنت دوما السند في قراراتي، في حياتي بأكملها ،

لا تتأخرين و لا تتذمرين و لا تترددين،

تبكين بصمت حين ترينني أتألم في مواجهاتي مع الحياة أو في مسيرتي الطبية،

و تذرفين دموع الحب و الفخر حينما أخيرا أشق طريقي نحو هدفي.

كنت ولازلت قدوتي في الحياة،

تساندينني و تشجعينني لأجل الإقدام على أي خطوة ومغامرة،

لأكتشفها و أكتشف ذاتي معها،

كنت خلف كل خطوة جميلة في حياتي،

مؤمنة بقدراتي حتى حين فقدت الثقة في نفسي.

لم تتأففي يوما من تكراري للقصص نفسها،

و تفرحين بنجاحاتي و الأخبار السارة كانك تسمعينها للمرة الأولى ،

إلى من لم تتركني وحدي في مرضى.

إلى من احتضنتني في كل لحظة و خطوة في حياتي،

تتفقدين علي حين تحسنين بي أبتعد،

سأشهد أمام الله أنك أعظم و أحن قلب و أنقى روح،

أمي،

أحبك بكل صدق و امتنان،.

ابنتك الوسطى جهاد.

To my dad:

To the person who taught me how to be patient,

How to live with ease and how to live life.

To whom I've learned how to loosen up when things get tense,

to find fun while interacting with people and to enjoy every little moment,
singing, praying, interacting, whatever action I live it fully and enjoy it.

who always showed up, never got tired of getting along with my schedule.

Who never complains about my failure,

to the parent who showed me that a parent is also a friend, a dad, and a real man.

To the person who showed me how to be treated as a woman and as a female doctor,

to the person who took my hand and guided me through the darkness,

to the man who showed me that Allah will never fail u, so trust him.

To the Marrakeshi who always holds a smile within him, and always

makes us hide his worries and never complains of having trouble.

To the Man who showed me how to be dependent, while I only know how to depend on myself.

To my dad, whom I respect the most.

I love you, Daddy

I pray God to make me your daughter in every life.

إلى أبي الغالي

إلى من كان قدوتي في الصبر والطمأنينة،

علّمتني كيف أعيش حياتي ببساطة،

كيف أدبر توتري، و كيف أجد المتعة في كل لحظة أتعامل فيها مع الناس،

وأعيشها بكل تفاصيلها بكل رفق و احترام،

وأبتسم في الشدائد،

كيف أفتح قلبي للحياة، وأستمتع بأصغر التفاصيل في الدعاء، في الغناء، في أي لحظة أعيشها بكامل إحساسي.

رافقني في مشواري دون تذمر،

للذي لم يشتكِ يومًا من تعبي أو انشغالي،

ولم يُحاسبني على فشلي، بل آمن بي كما أنا.

إلى أبي، الذي أثبت لي أن الأب يمكن أن يكون أعزّ صديق،

وأصدق سند، وأقوى رجل...

إلى من جعلني أشعر بأنوثتي واحترامي كطبيبة وكإنسانة،

إلى من قادني من العتمة بنوره وإيمانه،

وقال لي دومًا : "الله لا يترك من يتوكل عليه".

إلى المراكشي، صاحب الابتسامة الدائمة ،

الذي يخفي همومه بابتسامة كي لا يقلقنا،

إلى من لم يظهر لنا سوى صورة الأب الحاضر، رغم كل ما يُخفيه في قلبه.

إلى السند الذي أتكئ عليه.

إلى أبي، الذي أحترمه من أعماق قلبي.

أحبك يا أبي...

وأدعوه من قلبي أن يجعلني ابنتك في كل حياة، فما من نعمة أحب من قربك.

To my dear sisters, SALOUA SARKADI and ICHRAQ SARKADI

This milestone in my life is not mine alone : it is the fruit of your love, support, and unwavering presence throughout every step of my medical journey.
Thank you for your endless sacrifices, for your patience when I was overwhelmed, and for your belief in me when I was full of doubt. You gave me the foundation to dream and the strength to persevere. Your unconditional love, quiet prayers, and constant encouragement have been the greatest source of light through every challenge. You are the reason I kept going, and this achievement is just as much yours as it is mine.

To my dear sister Saloua Sarkadi,

To my sister, who takes on the role of a mother with so much love and care,
always worrying about me, standing by my side, and believing in me even when I doubt myself.

To the one who would willingly give a part of herself to me, even if that means she will stay with none,
to my sister, who is my biggest supporter, my trusted listener, and my guiding light through every twist and turn.

We've shared tears and laughter, adventures and dreams,
and plotted plenty of fun little schemes along the way (hhh).

I love you more than words can say.

And I pray GOD you achieve every single dream you still dream of.

To my dear sister Ichraq Sarkadi,

Only God knows the special place you hold in my heart.
I never imagined I would find a friend in my sister until we traveled together and explored new cities abroad.

But what we truly discovered was that we are good for each other — we find comfort and refuge simply in each other's presence.

We also learned to give each other a chance to be understood, and as the latest challenge says, we've played the game of listening without judgment, even if unconsciously.

I love you, Ichraq, and I wish you nothing but the very best in life.

To my grandmothers
Haja gouga Yamna and Haja fadma Latif

إلى جدتي يمنة غوغا و جدتي فاضمة لطيف

On this special day, my heart cannot help but long for your presence. I often wonder how it would have felt to share this moment with you by my side—how your warm smiles, wise words, and gentle presence would have added depth and meaning to this celebration.

Your absence is deeply felt, yet your memory lives on in everything I do. I carry your love, strength, and prayers with me always. Today, I honor you both not just for being extraordinary grandmothers, but for the legacy of grace and resilience you left behind.

I love you endlessly, and I dedicate this achievement to you with all my heart.

May your souls rest in eternal peace.

To my uncle Abdeljalil Sarkadi, عبد الجليل السرقادي

I wish I could have you here with me today, on this honorable and long-awaited day. Your absence leaves a silence that speaks volumes, a deep void in our hearts and in our lives.

You weren't just family; you were a confidant, a friend, and the cool uncle we could always count on. We cherished the freedom to talk to you about everything and anything, knowing we would always be met with kindness, understanding, and a good dose of humor.

Your memory lives on in our laughter, in our stories, and especially in moments like these, when we wish you were here to celebrate with us.

You are missed beyond words.

TO MY LATIF FAMILY,

My aunts: Khadija latif, zaina latif, Latifa latif, nadia latif and Habiba latif.

to my dearest cousins: "Nafissa abakarim, Sanae Faik, Atoufa faik, Taieb Latif, Hiba Echaroui"

This journey through medical school has been one of the most intense and transformative chapters of my life, and I owe a great deal of it to your unwavering love and support. Today, as I reach this important milestone, I carry each of you with me — in every lesson learned, in every challenge overcome, and in every moment of triumph.

TO MY SARKADI FAMILY,

Your love, support, and presence have been the foundation that carried me through every challenge and every sleepless night of this long journey. Through moments of doubt, exhaustion, and growth, you stood by me with patience, encouragement, and unwavering faith.

To each of you — thank you for believing in me even when I couldn't believe in myself. Your sacrifices, understanding, and kindness made all the difference. You gave me strength when I felt weak, hope when I felt lost, and joy in moments of pressure and stress.

This accomplishment is not mine alone. It belongs to all of you — my pillars, my safe haven, and my greatest blessing.

With all my love and gratitude,
I dedicate this work to you.

To my aunt Sarkadi Aicha,

To the loveliest soul in the family, "عمتووووو" ♡
To the one who will always hold me as her own daughter…
To the one whose shoulder never failed me whenever I was broken…
To the most angelic aunt in the entire world, the one who will guide me, support me, and love me unconditionally…

You've seen me in all my phases, all my ages, all my moods.
At my calmest, at my loudest, at my strongest and most fragile.
You never flinched, never wavered. You stayed.
And for that, I love you more than words could ever say.

To my friend Hajar SADIK,

To the unexpected gift God sent me

You have seen me through every chapter — my stumbles and my triumphs alike,

always there

You witnessed my falls, my victories, my moments of doubt and hope.

You taught me that friendship is not always about answers,

But sometimes simply being there quietly,

Together, we've weathered storms and celebrated joys,

Through every high and low, we've walked this path side by side.

shining light on each other's path along the way.

Thank you for being my source of strength.

Here's to many more journeys together, side by side.

Oumaima rouija,

To the calmest person I have ever known,
the one who shows love not just in words but through every action,
the one who opens her heart to everyone and is cherished by all.

Your dedication of time and care to your beloved ones
is a true testament to your generous and loving spirit.

I honor you for your quiet strength, your kindness,

To my friend mariame younsi,

To the one I practically need an appointment to see!
I dedicate this work to you…
To the late nights we've spent preparing meals, but never study hhh
To the unforgettable summer heat we endured together,
And to the countless study sessions we powered through side by side.

Thank you for being part of this journey, in your own unique, quiet way.

To my friend Fatimzahra Achdami,

to the uniqueness that shines brightly in every moment.
Your gentleness is a balm to those around you,
and your calmness, even in the toughest of times (hhh)
is a source of strength and reassurance.

No matter how difficult the path became,

you stood unwavering, never flinching or losing faith.

Your steady presence has been a guiding light for me,

and your quiet resilience has inspired me more than words can express.

Khadija Guerouane,

To the person with whom I instantly connected,
The one who understood the core of who I am and embraced me without judgment.

We've shared countless moments throughout this journey,
From studying side by side, to preparing meals together, to confiding in each other during times of sorrow and struggle.

You've been a constant presence, both in the quiet and in the chaos.
And for that, I dedicate this work to you, with all my gratitude and affection.

To all my friends, Hajar ladnany, Mohamed Rida Souaiki, Oussouqe Fouad, elbadii Badr, Tarik Sadik"
and to my cousins-friend= Hamza Meftahi, and Fatimzahra meftahi"

Thank you for being a part of this journey, in all its highs and lows. Your support, laughter, and companionship helped me navigate the most challenging moments with a little more ease and a lot more strength.

Whether it was a simple message of encouragement, a shared coffee during a study break, or your silent understanding when I needed space, you were there. You reminded me to breathe, to laugh, and to believe in myself when everything felt overwhelming.

Your presence, no matter how near or far, meant more than you know. This achievement is made all the more meaningful by the memories and friendships that came with it.

To my childhood friends,

Siham Bakhdour, Sara el Bouhali, Safa Elhsouni

I dedicate this work to you —
To the moments we lived together, and the dreams we spoke of with hope and excitement.
To the memories we created and the events that brought us even closer.

Thank you for being part of the journey.

To Professor, Mouhaoui

Who taught me how to be a doctor, who taught me the real medicine, how it is done, how to love it, how to be patient, when I was lost and my medical flame was vanishing.

I owe you who I am right now, with your lessons, time dedication and selflessness to your students.

To Dr. Essoli Samira and Dr. Elmansouri Ouassim

I dedicate this work to both of you, to the contribution and dedication you have put through this work.

To Dr.Samira Essoli

I appreciate your unwavering support, for your time and patience

Your guidance illuminated me, the interaction with you has made me achieve the work of today,

I've come to admire you even more,

We have worked side-by side, discussing, arranging meetings even on weekends, we spoke about everything around the research team and also about every detail of our medical journey.

I wholeheartedly acknowledge you as my mentor through this meaningful journey,

To myself:

ACKNOWLEDGMENTS

To Our THESIS PRESIDENT PROFESSOR AMINE MOHAMED, PROFESSOR OF CLINICAL EPIDEMIOLOGY and Head of Public Health department At MOHAMED VI UNIVERSITY HOSPITAL OF MARRAKESH

It is with profound honor and heartfelt gratitude that I acknowledge your presence as the President of my thesis jury. Your acceptance to chair this committee and dedicate your time to evaluating my work is a privilege I do not take lightly. I am truly grateful for your willingness to take on this important role, and for the guidance and insight your presence brings to this academic milestone.

Throughout my academic journey, your exceptional human and professional qualities have consistently stood out. Your unwavering commitment to your students, the rigor and clarity of the education you provide, and your deep passion for medicine have left an indelible mark on all of us who have had the privilege to learn from you. Your example has shaped not only how we think as future professionals but also how we aspire to carry ourselves as individuals devoted to meaningful and ethical work.

Please accept the
expression of my deep and honest gratitude and huge respect.

TO MY ESTEEMED SUPERVISOR AND THESIS RAPPORTEUR, PROFESSOR ADARMOUCH LATIFA; PROFESSOR OF COMMUNITY MEDICINE, PROFESSOR AT THE DEPRTMENT OF PUBLIC HEALTH

I truly believe it was God's destiny'that brought me to you
I extend my deepest gratitude to the remarkable patience you've shown throughout this journey,
for your empathy during my difficult moments, and your unwavering support even when my work fell short of expectations.
You never gave up on guiding me.
You put faith in my potential and stood by me with understanding and kindness.
This entire experience felt like an adventure, unfamiliar yet deeply enriching.
Even amidst tight deadlines and pressure, you remained calm, patient, and supportive.
You helped me discover my strengths, challenged me to grow, and shaped a part of who I am today.
I will always cherish this chapter and carry forward the lessons you've taught me, far beyond this academic journey.

<u>TO OUR ESTEEMED JUDGE, PROFESSOR SEBBANI MAJDA,</u>
<u>Professor of COMMUNITY MEDICINE</u>

I am profoundly honored to have you serve on my thesis jury. The mark you've left on my academic path is both deep and lasting your patience and understanding fostered a safe and supportive learning environment for all of us

Your meticulous attention to details, coupled with your kind-hearted personality. Your exceptional dedication to medicine isn't just visible in your brilliant academic work, but shines most brightly in the compassionate care you show your patients and students. The genuine warmth with which you approach teaching has transformed our educational journey. Grateful for the way you created a positive atmosphere in the Amphitheaters and for who you are as a human being.

You didn't just teach, dear professor; you inspired, and that has made all the difference

TO OUR ESTEEMED JUDGE, PROFESSOR KHOUCHANI MOUNA, PROFESSOR OF RADIOTHERAPY AT THE HOSPITAL OF MARRAKESH

We would like to extend our deepest gratitude for the honor of your presence on our thesis jury. We are sincerely thankful for the valuable time and effort you devoted to revising our work, as well as for your kind participation in the jury panel.

Your expertise in the field of radiotherapy, your critical insight, and your attention to detail have greatly enriched the evaluation of this thesis. Your contribution reflects the high standards of academic and professional excellence, and we are truly privileged to have benefited from your perspective.

Your presence at this important stage of our academic journey is a mark of distinction for us, and we are most grateful for your availability, generosity, and engagement.

TO OUR ESTEEMED JUDGE, PROFESSOR MOUTAJ REDOUANE, PROFESSOR OF PARASITOLOGY, AT THE MILITARY HOSPITAL OF MARRAKECH.

We are profoundly honored to have you as a member of our thesis jury. Your presence is a true privilege, and we are sincerely grateful for the time, attention, and expertise you have so generously devoted to the evaluation of our work.

We wish to thank you for your availability, your openness, and the generosity with which you accepted to accompany us in this important academic milestone. Your participation reflects the spirit of excellence and dedication that defines the medical and academic community to which we aspire.

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ABREVIATIONS

LIST OF ABBREVIATIONS

URE : Undergraduate Research Experience.

UMRE : Undergraduate Medical Research Experience

GP : General practitioner.

SET : Social Exchange Theory.

OCB : Organizational Citizenship Behavior.

SCCT : Social-Cognitive Career Theory.

SDT : Self-Determination Theory.

OUTLINE

Contents

INTRODUCTION

The Council of Undergraduate Research (CUR) defines Undergraduate Research Experience (URE) as “an inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline” (1). During this experience, students work side by side with faculty members (2). Undergraduate research originated in 1969 at the “Massachusetts Institute of Technology ” (MIT) in the USA, where undergraduate students were recognized as an important part of the scholarly community (3).

This recognition was pursued by “The Boyer Commission”, in 1998, declaring undergraduate research experience as a mandatory element before obtaining any scholarly degree (4). Accordingly, the Undergraduate Research Experience (URE) has evolved from a “cottage industry” to a “movement”(5). Additionally, Undergraduate medical students started taking significant interest in undergraduate research experiences (6).

The goal of Undergraduate medical research aligns with the purposes of medical research, which are the advancement and enhancement of healthcare practice (7,8). Undergraduate Medical Students have their significant contributions through these experiences, leading to tremendous innovations (9). For instance, Jay Mclean, in his medical student years, discovered heparin. In addition, Paul Langerhans identified, during his medical studies, the pancreatic islets of “Langerhans” and the dendritic cells in the skin, known as “the Langerhans cells” (9).

Undergraduate medical students develop numerous skills through research, such as analytic and critical thinking (10). They also develop the “Evidence-Based-Medicine” practice, important to optimize clinical practice and enhance the patient-care and assessment based on new clinical-practice-guidelines that are in constant adjustment, due to the development of the clinical practice (11). These research skills, are essential and mandatory for future practitioners. Consequently, nurturing these future practitioners with research skills early, at the undergraduate level is a need of the twenty-first century (12-16).

Faculty members consider undergraduate medical experiences a valuable opportunity to mentor their undergraduates in the research process, as well as in clinical practice. This method of learning is known as “research-based learning”, where the educational environment shifts from its traditional methods, focusing on active learning instead of being passively receptive(17). In

general, peer-reviewed publications are important for most faculty members, considering their impact on professional career advancement (18). Yet, publications with undergraduate medical students also push forward faculty members' scholarly agenda and enhance their ranking(19–22). Faculty members are expected to excel in both teaching and publishing(12). Yet, administrative and departmental activities already take a big part of faculty members' schedules (12,23). Therefore, it seems challenging to find time and motivation to engage undergraduate medical students through these experiences (23). What's more, studies should evaluate faculty members' perspectives on Undergraduate Research Experiences in the medical field, to assess how their workload affects the accomplishment of their scholarly missions (24), and explore the motivations that push these faculty members to engage undergraduates in such "high-impact" educational experiences(25).

Undergraduate research experiences generally fit into two models: curricular undergraduate research experiences and co-curricular undergraduate research experiences. This means that research experiences at the undergraduate level can either be, respectively, an integral part of the curriculum that all undergraduates are expected to participate in, or they can be a voluntary activity based on undergraduates' personal interests and motivation levels (25).

In Morocco, completing research work is a mandatory requirement before obtaining any degree, a policy recognized nationwide. The Faculty of Medicine and Pharmacy in Marrakesh, as well as other institutions of general medicine, whether private or public, expect their final-year medical students to complete a medical thesis before receiving their medical degree (MD) in general medicine.

Undergraduate medical students start clinical clerkship rotations in their 3rd year. While in the two first years, they attend theoretical courses. Undergraduate medical students are exposed to research activities, mainly as observers. In a few departments., Faculty members may attribute different tasks to undergraduate students. Undergraduate students are usually credited as co-authors alongside other contributors in scientific publications.

No structured undergraduate research experiences are established in Morocco. The few involvements of undergraduate medical students in research reflect a personal commitment and effort from the faculty member's side. On top of that, clerkship rotations are assigned randomly.

Therefore, a limited number of undergraduate medical students are exposed to research activities before their theses.

The outcomes of these involvements are unknown. No data has been found in the literature about these experiences and the feedback of both undergraduate medical students and faculty members through these e experiences.

The absence of data in the literature review inspired the investigator team to lead a study project around undergraduate medical research experiences, at the Faculty of Medicine and Pharmacy of Marrakesh. A research project exploring both perspectives, those of faculty members and undergraduate medical students.

This study aimed to explore faculty members' experiences, perceived challenges, and benefits through undergraduate medical research.

Objectives of the study:

The objectives of this study were to:

- explore faculty members' perceptions regarding Undergraduate Medical Research Experiences (UMRE) in the Faculty of Medicine and Pharmacy of Marrakesh.
- Analyze their motivations and challenges towards Undergraduate Medical Research Experiences.

Conceptual framework:

I. Definition of concepts:

Not much attention was given to the definition of Undergraduate Medical Research in the literature. Despite its importance in shaping undergraduate students in the medical curriculum. For this study, we refer to UMR using the broader concept of Undergraduate Research Experience (URE) in medical studies.

The 'URE' definition has been granted a 3-year project by The Carnegie Academy for Scholarship of Teaching and Learning (CASTL), which hosted its 2006-09 CASTL Leadership program around the "URE" theme, involving 9 other institutions (26). They basically founded their debate around the definition stated by (CUR), the Council of Undergraduate Research, which defined the (URE), "an inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline" (1)

All institutions reached a consensual midpoint agreement. No constant definition can fit the large concept of URE. Instead, definitions differed between two main institutional contexts or pedagogical goals. Therefore, URE may take different forms:

Student, process-centered Versus outcome, product-centered

In some institutional contexts, the goal of URE is the student's learning journey, focusing on their professional and personal growth. Other faculty members valued more the publication of a high-quality article.

Co-curricular fellowship Versus Curricular programs

In other contexts, Institutions develop summer undergraduate research fellowships, consisting of a short-term timeline (The co-curricular programs). In contrast, the curricular-based URE is defined as an integrated component within the medical curriculum with pre-defined academic objectives.

All students Versus Honor students

Accordingly, URE may include all students, ensuring equality in such experience exposure. Meanwhile, others are more selective, and students enrolling in these fellowships are the "Honor students" who excelled academically.

Collaborative Versus Individual

Working dynamics in research can be either individual or collaborative. Individual work is rare and involves undergraduates designing research and conducting the work by themselves, under the supervision of faculty. In collaborative models, faculty members are the ones who come up with the research topic and design the project, plus they assign students smaller tasks to attain authorship and mentor undergraduates through the research process.

Faculty-initiated versus Undergraduates-initiated

Therefore, the initiative of UMR could start from faculty members, like the collaborative research work. On the other side, undergraduates could be the ones who initiate such experiences.

Inter and multi-disciplinary collaboration Versus Discipline-based

Finally, UMR can foster multi-inter-disciplinary collaborations by engaging staff across different departments. These collaborations are essential to solving complex questions requiring approaches from different fields of expertise. Meanwhile, URE within the same discipline are more frequent, and their main goal is a publication in journals.

To sum up, URE consists of a dyadic relationship, a mentor (faculty members), and a mentee (Undergraduate medical student)

These Undergraduate medical students: are individuals whose identity as physicians' shapes all throughout their medical studies. The Physician Identity (PI) of first-year undergraduate medical students is grounded on humanistic attributes like empathy, compassion, and care. Meanwhile, fourth-year undergraduates focus more on clinical excellence. This identity is influenced by the values and image that are exhibited by their exemplary mentors (27).

Meanwhile, faculty members: are the teaching and administrative staff who hold an academic rank in a medical school (28).

And Mentoring: is the process where mentors (faculty members in our context) provide academic support, but also psychological support, to a mentee (undergraduate medical students in our study). All to promote students' professional and personal development (29).

Considering the rapid pace of innovation in medical science, technology, and practice, developing a pool of talented biomedical scientists in the [United States] is of paramount importance (30,31). Accordingly, developed countries have been taking encouraging steps and have developed programs to foster research culture at the undergraduate level. Research programs are optional in the U.S.A. and the U.K., fostering volunteer research programs for undergraduate medical students. In Germany and New Zealand, medical students are required to participate in research (32,33).

As a consequence, publications by undergraduate medical students represent a large body of the overall medical research output in developed countries. In Germany and New Zealand, 28 % and 32,7%, respectively, represent the rate of articles authored by medical students of the overall scientific research output. (33,34). Meanwhile, Turkey's publication rate in health sciences and medical theses represents 11,9% of the overall scientific research rate output (35).

Publishing a manuscript, earlier at the undergraduate level, is seen as one of the main measures of progress of a country in the world of scientific community (36). In Morocco, medical students are pursued to present their theses in front of a judge panel, in their final year. And hundreds of these are defended every year. However, a large number of those theses are archived in online libraries, in their respective Moroccan medical school platforms, with an open-access in some and a restricted one in others. Also, their scientific impact on Moroccan medical schools is undefined(37).

II. Conceptual framework:

Perceptions are about the grounded beliefs and opinions of faculty members that they established based on different factors. To understand these dimensions, we adapt Morales' (38) framework model, which offers a detailed explanation of faculty members' motivations. This latter framework is already derived from Allen's (39) models of understanding motivations in mentoring relationships. Extending this framework to a medical school context, where undergraduate research experiences in Morocco are sporadic and informal. The purpose of adapting this framework is to break down faculty members' perceptions into different domains, to understand their overall perspectives around undergraduate medical research.

Morales' (38)model consists of explaining the motivations of faculty members based on five domains (39). Previous mentoring experiences, demographic factors, expected costs and benefits, dispositional factors, and finally, situational factors

1. Previous mentoring experience:

Our conceptual framework correlates the motivation of mentoring undergraduates through research experiences with the presence or absence of any previous mentoring experience. Accordingly, faculty members who already mentored undergraduates through research exhibit motivation for future undergraduate research experiences, supported by the findings in the literature (40–45).

2. Expected costs and benefits:

Costs and benefits are two essential elements controlling faculty members' motivation. The Social Exchange Theory (SET) justifies this duality by defining the engagement of individuals among themselves as a give-and-take relationship (46–49). Therefore, faculty members anticipate a certain gain through their interaction within undergraduate research experience (50,51). Recognizing that individuals, including faculty members, assess the benefits of the time and effort provided. Based on the Social Exchange Theories, the faculty member calculates the benefits and risks it might cost them through mentoring. Therefore,

they are motivated to engage undergraduates when the perceived benefits outweigh the anticipated risks (50).

Therefore, the motivation of faculty members in undergraduate medical research is related negatively to the “expected costs” and related positively to the “expected benefits”.

3. Dispositional factors:

Informal mentoring in undergraduate research experience goes beyond the academic objectives, and faculty members no longer expect a concrete reward in return for mentoring. Faculty members find a sense and willingness to engage these undergraduates through research. In some cases, their engagement with undergraduates under a research framework might even put their competencies in question, especially when undergraduates show low performance (44,52,53). Nevertheless, some faculty members continue providing undergraduates the mentoring privilege, mentioned previously as the “labor”.

Support for this behavior comes from the “Dispositional factors”; which are internal characteristics that control our actions in our daily life, influencing how we think, feel, and behave. Morales (38) relied on the “Organizational Citizenship Behavior” to understand the intention behind the faculty members’ motivation in engaging undergraduates through research. It’s an overlooked concept, yet essential to break down what pushes faculty members internally to engage in such experiences, without waiting for much in return.

4. Situational factors:

In psychological behaviors, the interactions between individuals can be explored through both internal factors, “Dispositional factors”, and external ones, ‘situational factors”. Accordingly, the motivation of faculty members is also controlled by some external factors and environmental ones, either negatively or positively affecting their motivation. This conceptual framework links the motivation of faculty members in mentoring experiences with three elements that compose these situational factors: institutional reward system, opportunities for interactions, and monetary resources (47,54,55). In other words, the presence or the

absence of these environmental parameters negatively and positively influence the willingness to mentor through undergraduate research experiences.

Tenure and promotion policies exist within some universities and illustrate that these universities recognize faculty members' efforts. Therefore, faculty members belonging to universities adopting these reward systems are more motivated to engage undergraduates in research. As for the opportunities for interactions, any element hindering or facilitating the establishment of an interaction between a faculty member and an undergraduate student, under the framework of research, influences the motivation of these faculty members. In some departments, faculty members have no access to undergraduate medical students, which means they can't engage in undergraduate research experiences. Or because of the low performance of undergraduate medical students, faculty members' motivation gets negatively influenced. In contrast, faculty members who have access to undergraduates involve them within their research projects, also faculty members are likely motivated when they encounter undergraduate students who are academically prepared and qualified to work with. In terms of financial resources, research funds positively influence the motivation of faculty members.

5. Demographic factors:

The present conceptual framework extended the understanding of faculty members' behaviors beyond their psychological growth. Faculty members' characteristics, gender, and race, among others, are also elements influencing faculty members' motivation. The Aagaard et Hauer et aL's (56) study suggested that female faculty members exhibit more motivation in providing undergraduates' supervision through research, compared to male faculty members. In our study, race and color weren't applicable.

Historically, mentoring others through research is a concept supported by career and life stage theories (57). Suggesting that mentoring is a process occurring during midcareer years, where mid-careerists focus on providing junior colleagues with mentoring benefits, as a key development for their professional growth. Accordingly, faculty members at their mid-career

stages show strong motivation in involving undergraduates through research, compared to those at early-stage career or late-stage career.

Discipline is another component influencing faculty members' motivation, and it is believed that faculty members belonging to life-science disciplines are motivated to engage undergraduates through research experiences, compared to faculty in disciplines other than life-science.

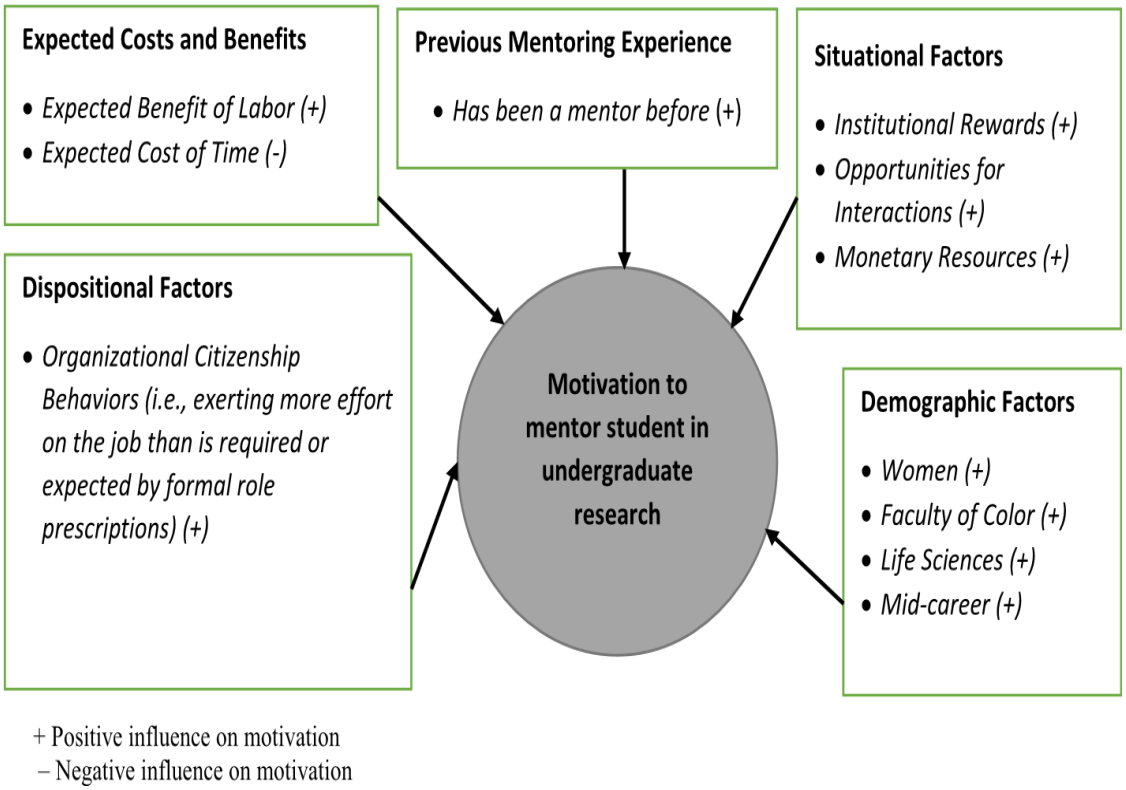


Figure 1: Conceptual model, + Positive influence on motivation, – Negative influence on motivation

PARTICIPANTS AND METHOD

I. Study type

In order to explore new insights and different perceptions, we opted for qualitative research methodology.

II. Study population

We targeted all faculty members belonging to the Faculty of Medicine and Pharmacy at Marrakesh.

Participants were selected based on specific criteria to ensure richness and relevance of the Data, as follows:

Inclusion criteria

- Any academic rank: Assistant professor, Associate professor, Professor of higher education.
- They either had or had no previous experience in a research project with undergraduate medical students.

Non-inclusion criteria

- Any faculty members who declined to participate in the interview.
- Professors who were no longer part of the faculty of general medicine in CADI AYYAD's body, due to their resignation or retirement.

III. Sampling

Sampling was based on a non-probabilistic method in order to examine different criteria. The composition of the sample followed predefined selection criteria, aiming for diversity:

- Gender (Female, Male)
- Profile (Medical, non-medical : Scientific)
- Discipline: for the medical field: Biology, Medicine, or surgical department
  For non-medical fields: either belonging to the biology or technical department
- Holding or not, an academic responsibility
- Being a head department chef or not
- Having a prior experience in undergraduate medical research or not

IV. Interview guide

The interview guide was elaborated with a simple mindset to cover 4 themes:

Theme 1: Experiences of faculty members in undergraduate medical research: reporting faculty members' own experiences in involving medical students or observed undergraduate research experiences in other contexts.

Theme 2: Perception of faculty members: exploring different opinions on undergraduate medical research, including the feasibility of these opportunities in our Moroccan context, and their opinions on the importance of such activities.

Theme 3: Challenges and needs identified by faculty members: perceived challenges of faculty members if they ever engaged undergraduate medical students through medical research.

Theme 4: Benefits derived from undergraduate medical research: perceived benefits positively impacting faculty members, medical students, and institutions. These benefits were potential motivations for faculty members in engaging undergraduates in upcoming medical research experiences.

V. Data collection

The research team developed the interview guide, which is available in the appendix section (Appendix 1). All interviews were conducted, transcribed, and analyzed in the French language to avoid any language bias that could potentially interfere with data analysis. On top of that, the research team wanted to allow participants the opportunity to express their perspectives with ease, since French is the first foreign language in Morocco.

We elaborated a participation consent form, available in the appendix section (Appendix 2). This form was communicated to all potential participants in order to clarify the study purpose, collect their consents, and arrange interviews accordingly.

The investigator team, which conducted interviews, consists of 3 members. At least two were present at the interview site. The data collection lasted from 25th June 2024 to 24th July 2024, each interview ranged from 8 minutes and 6 seconds to 34 minutes and 23 seconds.

All interviews were conducted after faculty members' approval, face-to-face, depending on their availability and preference. Some took place at the Faculty of Medicine and Pharmacy of Marrakesh.

Others were conducted in each faculty member's department at the university hospital or the military hospital of "AVICENNE" in Marrakesh.

All records were anonymous and were used for transcription purposes. The interviews were transcribed word by word. Silent and laughing sounds were mentioned too. Some difficulties were encountered while transcribing, which influenced the flow of ideas, such as interruptions by phone calls or by someone entering the interview room.

Recruitment was pursued until data saturation, where no new theme emerged, defining the sample size at 22 participants.

VI. Data analysis

The thematic content analysis was conducted by two investigators. Each one of them read the transcripts multiple times to gain a deep understanding of the content, and they individually coded responses. These codes were generated manually and organized into themes and sub-themes, following the conceptual framework. The data coding was carried out using Microsoft Excel®. Contents of themes and sub-themes were refined by frequent online meet-ups between the two investigators, via Google Meet, where they discussed everything, but focused mainly on problematic categories to reach consensus.

Unlike the Morales' study, our aim was not to identify factors influencing the motivations of faculty members in URE; we relied on Morales' conceptual framework to break down the different perceptions of faculty members into categories, to understand in-depth their beliefs, challenges, and benefits of undergraduate medical research

Some codes couldn't fit into any domains of Morales' conceptual framework. Therefore, we relied on two other behavioral theories included in dispositional factors, explaining the perceptions of faculty members through career development theories, as they directly influence the Organizational Citizenship Behavior (OCB). The theories combining the rest of the codes are the self-cognitive-career theory (SCCT) and the self-determination theory (SDT).

SCCT explains individual behaviors by three main elements: individuals, including faculty members, assess their career development goal (personal /performance goal) by measuring their

capabilities (self-efficacy) as mentors through URE, while anticipating consequences (expected outcomes).

SDT is more about fulfilling three basic individuals' needs: while engaging in any activity, faculty members' initiations are self-chosen and explained by self-beliefs and self-willingness (autonomy), combined with a feeling of connection and a sense of belonging to others (relatedness), and a feeling of capability (competence).

VII. Timeline of the study

Table 1: Chronogram of the study

	Jan.	Marc.	Apr.	Mai	June	July	Oct.	Nov.	Dec.	Jan.	Feb	Ap.	Jun.	Jul.
Start of the study														
Literature review+ accelerated program														
Synthesis of the literature review														
PPT on the literature review														
Elaboration of the research protocol														
Submission to the ethical committee														
Approval + Data collection														
Transcription														
Meeting														
Analysis+ Meetings														
Presentation of results														
Thesis writing														
Meeting														
PPT presentation														
End of the study														

VIII. Ethical considerations and regulatory aspects

This study was conducted after approval by the ethics committee (105/2024). The approval paper is attached in the appendix section (Appendix 3).

The ethical principles of "the Declaration of Helsinki" were respected. Participation was voluntary, and consents were obtained after delivering the consent form to each potential participant before the interview date. This latter form contained an explanation of the study objectives and its non-lucrative character. Throughout the study, we made sure to secure the confidentiality of collected data. Also, a clear verbal consent to conduct and record the interview was obtained at the beginning of every recording. The recordings were deleted after finishing the qualitative analysis.

Results:

I. Socio-demographic and professional characteristics of faculty members:

Twenty-two participants were interviewed. The sociodemographic and professional characteristics are shown in the table below (Table 2). These interviews were conducted face-to-face, either at the faculty members' respective departments or at the Faculty of Medicine and Pharmacy of Marrakesh.

All interviews were individual one-on-one sessions, except for one dyadic interview (4,5%), where two faculty members were interviewed simultaneously. The median length of all interviews was 19 minutes and 48 seconds. The maximum interview lasted 30 minutes and 7 seconds, while the minimum one lasted for 8 minutes and 7 seconds.

An equal number of male and female interviewees came from a wide range of disciplines, with most coming from medical fields and biology, representing 72.7% of the sample. Faculty members' academic levels ranged from higher university professors (16), associate professors (03), habilitated professors (01), and assistant professors (02). The sample is composed of 10 head department faculty members, representing the minority with a 45,5%. Out of 22 participants, 6 had at least one previous undergraduate research experience with a medical student, versus 16 other participants who had no prior experience in undergraduate medical research

According to faculty responses during interviews. Female faculty members and male faculty members had equally the same experiences in mentoring as male faculty members. Meanwhile, faculty members who were in their late-career and mid-career stages had the most previous undergraduate medical research experience, compared to those in early-career faculty. Also, faculty members from medical fields (we note faculty of medical departments, surgery and biology) had the most experience compared to faculty members from science and pharmacy.

Table 2: Faculty members' sociodemographic and professional

	Number	Percentage %
Gender		
- Female	11	50.0
- Male	11	50.0
Professional grade		
- Higher university professor	16	72.7
- Associate professor	03	13.6
- Habilitated professor	01	04.5
- Assistant Professor	02	09.5
Profile		
- Medicine	17	77.2
- Scientific	04	18.1
- Pharmacy	01	04.5
Discipline		
- Biology	09	40.9
- Medicine	08	36.3
- Surgery	04	18.1
- Technology	01	04.5
Head of the department		
- Yes	10	45.4
- No	12	54.5
Interview type		
- Individual interview	21	95.5
- Dyadic interview	01	04.5
Interview duration (minutes)	19:48 (08:07-30:07)	
Supervision of an undergraduate medical research		
- Yes	06	27.2
- No	16	72.7

II. Main themes and sub-themes

The results regarding faculty members' perceptions around Undergraduate Medical Research (UMR) were categorized into themes and sub-themes based on the five domains of Morales' framework. Consequently, perceptions were divided into barriers and benefits, organized according to those five domains

1. Previous Mentoring experiences

1.1. Personal Mentoring Experiences in Undergraduate Medical Research

Engaging undergraduate medical students in research was reported by six (6) faculty members, versus 16 who never did. Undergraduates who participated in faculty research projects were mainly in their 4th and 5th year. Undergraduate medical students were involved in literature review and data collection. Participants reported that the quality of some students' work sometimes exceeded their expectations, and at times, was better than that of medical resident doctors. For example, a faculty member stated:

"We find out that they [undergraduate medical students] actually possess research competencies that we couldn't discover at the beginning, and we are marvelously surprised by the quality of the research they conducted." [Participant 9, Female, Medicine]

1.2. Reported Undergraduate Medical Research Mentoring Experiences

Few participants who had never engaged undergraduates through research reported observing similar involvement elsewhere. They reported other faculty members in other departments, including those who belonged to our institution, and those in other public and private medical institutions across Morocco. Others described the presence of such activities in foreign universities. Faculty members acknowledged undergraduates' active contribution to data collection and questionnaire administration. Acknowledging the existence of such experiences despite the lack of personal involvement in undergraduate medical research. A participant stated:

"As you know, recently, many countries abroad have strictly instituted six months of dedicated research for every medical student — true research — and that is an honor for medicine, because research in medicine is essential." [Participant 4, Female, Science]

2. Expected costs Versus Expected benefits of 'Labor'

Faculty members who engaged in such experiences acknowledged the benefits they gained from Undergraduate medical research. Those are the "expected benefits of Labor". On the other hand, they admitted that these benefits came with challenges and barriers; those barriers are the "expected costs".

2.1. Expected "costs"

Fostering undergraduate medical research was not exclusively beneficial but costed faculty members some "risk". Typically, in terms of time management. Considering their "duality function" and their other preoccupations, leading to a burdened schedule. This made it more challenging to find a suitable time for both faculty members and undergraduates. Especially that undergraduates "lacked time". Moreover, faculty members considered that engagement of faculty members would cost them time and effort to supervise, but also their presence put the faculty members' "Clinical Data" in a potential risk of leakage.

a. Lack of time among undergraduate medical students

Some faculty members stated the hassle in finding a convenient time that could fit both undergraduates and faculty members. They explained that undergraduates' schedule was already filled with lecture attendance and preparation for exams. Also, both the medical curriculum in Morocco and the clinical enrolment in each department were shortened, which made it more challenging to involve undergraduates in research without compromising other clinical academic objectives. In this regard, a faculty member explained:

"There's the current context where medical studies now last 6 years. There have been a lot of events, including COVID-19 or strikes. Also, there is this short duration of clinical enrollment in our department, it has been shortened to 6 weeks, which was previously 8 weeks. We Barely to

organize some short lectures and OSCE for the benefit of undergraduate medical students, during this period." [Participant 10, Male, Medicine]

b. Duality function

Four participants recognized the challenge of managing the dual roles of clinician and researcher. They believed that the conduct of research required a full-time commitment. However, faculty members' schedules were already overloaded with other academic responsibilities, leaving no room for research. As a result, some faculty preferred not to engage in research, while those willing to allocate part-time to research activities felt that it would never be efficient or effective. Furthermore, if undergraduates took part in these research projects, the roles of faculty members would become unclear, fluctuating between supervising research and mentoring undergraduates in conducting research. One faculty member anticipated:

"And by the way, at the Faculty of Medicine, and at the pedagogical committee "congress", a previous member from this committee has stated that we should not anticipate research from faculty members, and especially authentic research, because they are already preoccupied by other things. And especially not pedagogical research, because they are absorbed by clinical activities". [Participant 18, Female, Medicine]

c. Scheduling burden

Ten faculty members stated their struggles in freeing up time for research to engage undergraduate medical students. Given their schedules, which were already filled with departmental clinical activities and academic responsibilities, including mentoring residents and medical students, besides the administrative tasks. They explained that it was impossible to prioritize research, given their staff shortages. Therefore, they had to handle the work by themselves in their respective departments. As a consequence, clinical care duties were prioritized over research. As a faculty member mentioned:

"*Faculty members, for most departments, they are absorbed by patients' care and all administrative activities"* [Participant 8, Male, Medicine]

d. Lack of research culture among undergraduate medical students:

The lack of research culture among undergraduate medical students was reported by 8 participants. They explained that undergraduate medical students focused mostly on clinical rotations and exam preparation, rather than taking an interest in research. Faculty members blamed institutions that cultivated such mindsets; institutions fostered a curriculum that focused on delivering knowledge related to clinical care rather than using research-based learning models. Therefore, medical students had no autonomy in initiating such experiences in research and lacked the culture of research. A participant added:

"Because undergraduates do not discover research until they arrive at the thesis phase…. On the other hand, they don't even know what a literature review is." [Participant 20, Female, Medicine]

Also, it fostered stereotypes around reward-based work, where research was done if a reward existed, rather than valuing the experience itself. Faculty members, partially, blamed themselves for nurturing such a limited mindset, explaining how their overprotective instinct towards their undergraduates created a hyper-dependent state among undergraduates and eventually a closed-mindedness, where undergraduates passively accepted all delivered knowledge without questioning or curiosity. In this context, a faculty member said:

"… The fact that undergraduate medical students were spoiled, we can say, starting from the first year. and now they acquired the conviction that all that is learn through medical studies is some kind of bible, and they cannot and don't have the right to search elsewhere" [Participant 19, Male, Medicine]

e. Fear of data sharing and access

One faculty member expressed the fear of losing ownership and data of their own research projects, to other departments. This fear was enabled by the involvement of undergraduate medical students who frequented other departments. Therefore, they preferred not to share all the Data with undergraduates, to prevent any leakage. Resulting in data centralization and a micro-involvement of undergraduates through research project. This was illustrated by the word "little", repeated several times by one participant. Emphasizing their preference for managing data in a single department, in order not to lose data to others. In this regard, a participant mentioned:

"*We also show them the results and we give them the database alongside its analysis. And probably, over time, I won't be giving him [undergraduate] the whole database, for instance, I will only provide him with a small part of it"* [Participant 3, Female, Science]

2.2. Expected benefits of 'Labor'

Faculty members expected benefits in return for their 'Labor'. Meanwhile, one faculty member described that the personal gains they retrieved from mentoring undergraduate medical students were linked to the quality performance of undergraduate medical students. Multiple benefits were detected through analysis, we categorized them into 5 main Benefits: advancement of research projects, requirement of new hard skills, expanding faculty members' productivity and network, Mentoring URE for succession, and attaining professional growth.

a. The Advancement of the research project:

Eight faculty members acknowledged the help they received from undergraduates while involving them through "Undergraduate Research Experiences" (URE). The contributions of undergraduate medical students led to the advancement of the research project, either by accomplishing tasks related to the research project. Which resulted in meeting up to deadlines and reducing time dedicated to research work; Among these participants, a few illustrated these undergraduates as "extra-hand", when present, always valuable, especially since faculty members struggled with other preoccupations.

A faculty member stated that:

"It's manpower [Referring to undergraduate students], because we don't have enough time to conduct research alongside healthcare activities and all. And time for research comes last. Probably, to win a bit of manpower."[Participant 15, Male, Medicine]

Meanwhile, one faculty member described the undergraduate role as being "the bridge" to other departments in collecting clinical files, addressing the lack of clinical data, and the access to patients' files in their units, especially in biology. Aligning with this context, a participant said:

b. Hard skills of faculty members

Among the expected benefits that could push faculty members to engage undergraduate medical students in research were opportunities for publications, therefore, authorship. Plus, faculty members anticipated they would learn new research methodologies through their exposure to undergraduate research experiences, enhancing their competencies, but also their research partnership opportunities. A participant mentioned:

"In my opinion, the sole motivation to convince faculty members is to achieve a publication; it's important." *[Participant 4, Female, Science]*

c. Expanding research productivity and network

Two faculty members revealed that undergraduate research experiences were beneficial when the results were communicated at international events. Also, when research collaborations extended across different departments, beyond faculty members to include resident doctors, interns, and finally undergraduate medical students. Thereby, these experiences demonstrated the potential for fostering interdisciplinary partnerships through undergraduate medical experiences. A faculty member mentioned:

"As for faculty members, it broadens their scope of scientific productivity, as they are going to collaborate with fellow faculty members, interns, medical resident doctors, with other healthcare faculty members. Alongside other staff within their department. And when an undergraduate join the team, their presence contributes to enhancing their department. Which enhances the scientific research network of their respective department." [Participant 14, Male, Medicine]

d. Fostering Professional Growth

Three participants revealed if URE production were recognized, it would serve faculty members to increase the number of their publications. One faculty member reported that the push button in motivating most of faculty members lay in gaining more publications, academically recognized in their professional portfolio. This recognition valued both faculty members' work and the undergraduates. More importantly, it helped faculty members in achieving professional growth through unlocking new skills, expanding experiences, and knowledge in their respective fields of

expertise. Contributing, ultimately, to attaining scholarly excellence and progressing in academic ranking. A faculty member explained:

"Maybe [the motivation] it's mentoring more undergraduate students to increase the publication rate. Hence, it will enrich their CV, I believe. And normally, a faculty member isn't expected to fulfill only healthcare delivery and supervision role within their departments; there's also research. And the more he mentors, the more it's beneficial for him, for his career and his CV." [Participant 20, Female, Medicine]

e. Mentoring for succession

Two (2) faculty members believed training individuals for academic succession was seen as a means to ensure continuity in faculty members' fields of expertise. Therefore, faculty members expressed that their benefits from URE were the acquisition of undergraduate medical students with a sufficient research background. Plus, URE was the perfect platform to detect medical students who would enjoy both research and teaching, while demonstrating leadership characteristics, a profile suitable for a research-oriented career, and a university-oriented career. A participant said:

"It's beneficial for him (undergraduate), the fact they will acquire research skills earlier. Also, beneficial for faculty members to mentor undergraduates for succession" [Participant 13, Female, Medicine]

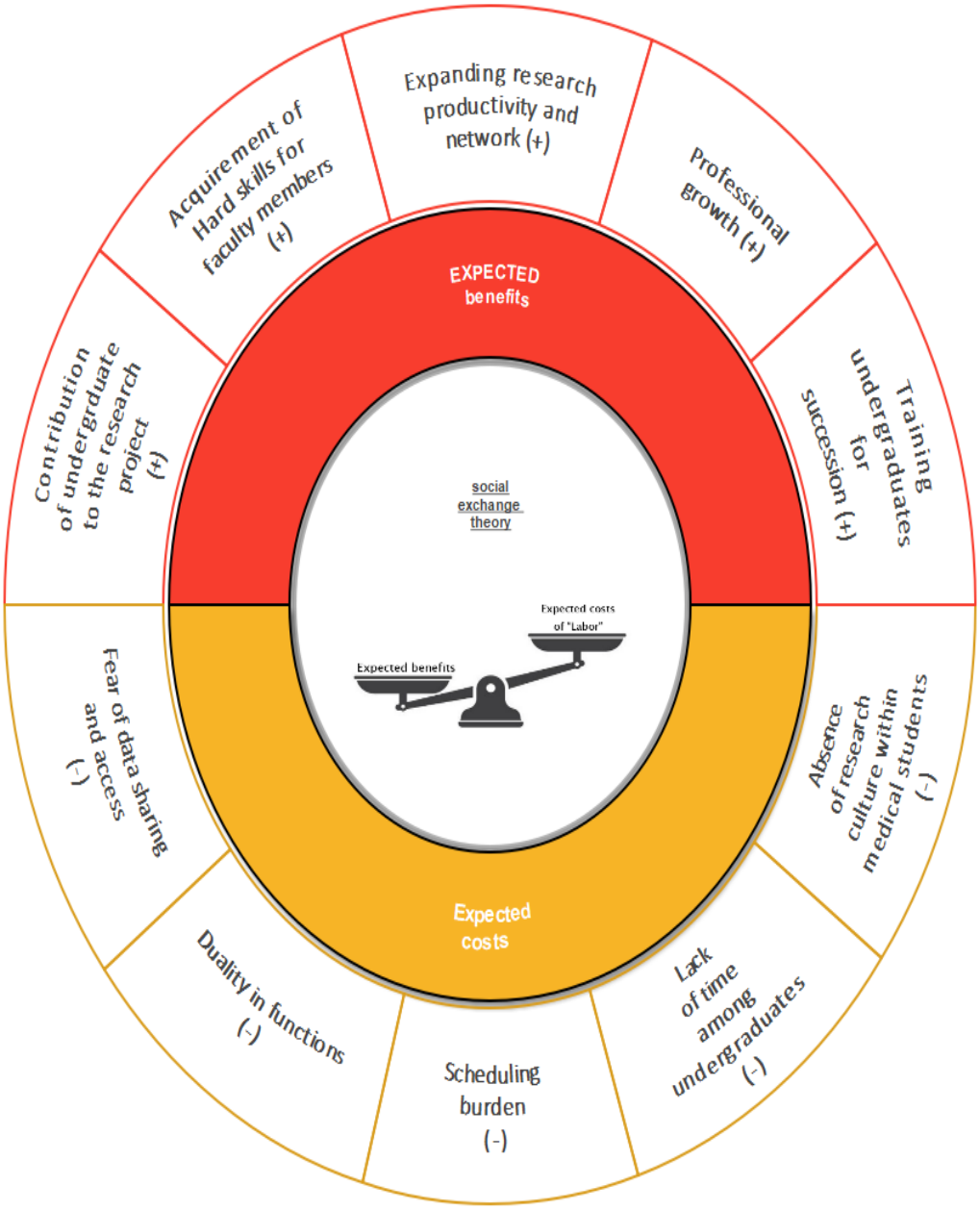


Figure 2: Perception of faculty members following the social exchange theory

This scale-like figure demonstrates that faculty members assessed the expected costs with the expected benefits of "labor". Each side of the scale includes 5 elements. Each element of the expected costs (in yellow) negatively influenced the motivation of faculty members towards undergraduate medical research. Meanwhile, the expected benefits positively influenced their motivation.

3. Situational factors:

Faculty members' motivation towards undergraduate medical research was influenced by different environmental factors that shaped their perception of undergraduate research. These factors were divided into three categories: the institutional rewards, demonstrating the reward policies in medical institutions. The monetary resources indicate the funds of research projects. And the opportunities for interaction, which were factors that either hindered the establishment of the relationship at first place, or made it difficult to maintain a healthy faculty-undergraduate dyadic relationship at the long term.

3.1. Institutional rewards

a. Rank advancement

Three participants discussed how undergraduate medical research contributed to the ranking advancement of faculty members. Accordingly, a participant stated:

"And normally, a faculty member isn't expected to fulfill only healthcare delivery and supervision role within their departments; there's also research. And the more he mentors, the more it's beneficial for him, for his career and his CV." [Participant 20, Female, Medicine]

b. Lack of administrative support.

Seven faculty members explained the lack of concrete support from the administration; which hindered faculty members from involving undergraduates in research projects, explaining if research was more valued, through financial incentives and published in indexed journals, rather than archiving thesis reports in the library. Also, if there was an effective supervision on thesis content to prevent fatal and erroneous results made by undergraduates. Only then, faculty members would mirror the administration's intentions by also prioritizing research. A faculty member added:

"Yes, we usually talk about research, but it doesn't exist no concrete measure to prioritize research. But if research became a priority in our medical university, and a priority amongst faculty members, I believe that's when we can engage undergraduate students." [Participant 15, Male, Medicine]

c. Quota bloquage

An academic barrier was reported by only one faculty member, when the institution limited the thesis quota to 4 theses per faculty member, explaining how it only hindered potential future publications. The participant stated that:

".. To permit 4 thesis topics per faculty member is a disaster; for me, it constitutes a pedagogical constraint against faculty members." [Participant 11, Male, Medicine]

3.2. Monetary resources

Two faculty members questioned the lack of financial support important to conduct research. Given that publications in journals required payment. Therefore, if funds weren't secured, who else could cover those costs. On top of publications' fee, some research projects required funds to ensure access to paid platforms, to finance laboratory tests. And sometimes, software programs used for analysis purpose and calculations, required prior payment. Especially that free versions often restricted access to key features. A participant said:

"The financial resources. some research studies require a financial contribution to pay for some services: to pay people, to run some biological analysis, to develop software … and if ever we ask the undergraduate student to use the artificial intelligence, it is important to note that the free version is less performant than the full version that demands payment. So, who's going pay!" [Participant 17, Male, Medicine]

3.3. Opportunities for interactions:

a. Limited access to students and patients

Six Faculty members expressed the lack of access to patients and undergraduate medical students. Five participants, out of 6, revealed that their limited interaction with undergraduate medical students during courses, alongside the short internship duration, made it challenging to initiate such experiences. Particularly in biology departments, where both accessing patients and undergraduates were challenging. They mostly worked on samples, also undergraduates rarely enrolled in biology departments, especially after the COVID pandemic. Emphasizing access to

undergraduates as the first step to establish a research-based relationship. In this context, one faculty member reported that:

"Well, during the 1st cycle, no, since they (undergraduates) barely enroll for a short 15-day internship, it's what we call observership, which lasts for 25days. Plus, we see fewer and fewer undergraduate students. And since COVID-19, they no longer get appointed to our department. This is basically the issue, it's our interaction with undergraduates, which is very restricted." [Participant 16, Female, Science]

b. Unmotivated Undergraduate medical students for research

Twelve faculty members expected reluctance from undergraduate medical students during their exposure to undergraduate research. This reluctance could result in a lack of commitment. And it was explained by numerous reasons: distractions by social media and phones in general, laziness, and a research mindset that focused mainly on rewarded-research context, a mindset if not changed at early stages, would lead to the current research situation, in Morocco; Where publications' rate increased when competitiveness towards applications rised. Reflecting the personal motives behind seeking publications, rather than genuine willingness. All of that negatively impacted the quality of research work and contributed to the publication of articles in non-indexed journals.

Accordingly, faculty members needed to engage undergraduates who demonstrated intrinsic motivation and affinity towards research. This aligns with what a faculty member mentioned:

"...The motivation, it comes within. However, it might concern mostly those with prior personal interest, or we could say, individuals with affinities; someone who leans towards enjoying research, appreciating the clinical aspects, and hands-on practice … But all these alone aren't enough, of course; it is a necessary kind of motivation, because if you appreciate conducting research, reading, and producing knowledge, then you'll be more engaged than others. And that is the motivation we are talking about." [Participant 18, Female, Medicine]

c. Underperformance of undergraduate medical students

Among 17 faculty members, some described undergraduate medical students' performance as Bellow average and their research-paper as non-publishable. Others expressed embarrassment over serious errors and ethical mistakes committed by undergraduate students. Participants linked this under-performance to the absence of any previous research experience and the lack of research theoretical background. This raised needs for guidance and structured mentorship throughout the entire research process. However, suggestions concerning mentors differed between requesting mentor-experts from the "medical research center", while one participant argued that research should occur across all departments. Thereby, all faculty members must envision strategies for mentorship purposes. An interviewee mentioned:

"To publish, a lot of skills must be mastered. For instance, in the literature review, it is necessary to receive training in biostatistics and get training in medical English." [Participant 17, Male, Medicine]

d. Chronic deficiency and insufficient training of human resources

The statements of 8 participants revealed a lack of human resources in terms of number and expertise. In fact, chronic deficiency in HR slowed down the pace of work at departments and interfered with undergraduates' involvement in research. Others reported an inverted faculty members-resident doctors' ratio, as faculty members, in some departments, outnumbered the residents, who facilitate the communication between undergraduates and faculty members, functioning as a part of a hierarchical process in all departmental matters. Meanwhile, one participant acknowledged their lack of expertise in meta-analysis methodology, resulting in turning down a request for supervision and guidance through the suggested research. For all these challenges, there is a need for more staff and a continuous training program to ensure proper training of faculty members before assigning them mentorship duties. One faculty member said:

"Mentors need to be trained, because everyone, and I'm talking especially about newly affected, young faculty members, because we are in need of new applications for the position of assistant faculty members, especially for these last two years. This training is something the epidemiological

department used to organize; they organized brief training sessions around clinical research and scientific writing of articles just to refresh the memory of early-career faculty members." [Participant 13, Female, Medicine]

e. Lack of material resources

Two faculty members expressed needs in terms of material resources. One faculty member required a staff room, to ensure efficient supervision in both clinical matters and research within a private setting.

Another faculty member added:

"Well-equipped research centers alongside secretarial services, a database, and so on… which will help us carry out high-quality research work." [Participant 18, Female, Medicine]

f. Massification in higher education

A minority of participants' opinions agreed that managing an enormous number of undergraduate medical students while mentoring them in both theoretical and practical aspects of research was clearly challenging. Given that the unrealistic ratio faculty members-undergraduate medical students, a faculty member indicated that:

"It is honestly very beneficial. However, we cannot, in my opinion, engage a class of 500 individuals, right away from the start." [Participant 13, Female, Medicine]

g. Lack of pre-existing research framework

Ten faculty members justified their hesitations and their non-involvement in undergraduate research experience by the non-existence of any structured research framework, where they can easily integrate and invite undergraduate medical students to join them. Some faculty members envisioned research framework as an academic objective integrated within the medical curriculum, where undergraduates were required to work on research. While others envisioned research framework as a concrete center containing expert staff in research serving as mentors to medical students through their medical studies, especially those who demonstrated interests towards

research but hesitated the initiation due to the lack of an effective program. A faculty member emphasized that:

"it's something that it's not included within the program." [Participant 13, Female, Medicine]

h. Absence of research culture at the institutional level

Five faculty members believed their lack in initiating such experiences was behind the lack of research culture at the institutional level. This lack contributed to shaping a mindset where research was never considered an option or a priority. Participants stated that the core mission of the Moroccan medical curriculum was to develop future general practitioners (GPs) in clinical care exclusively. Meanwhile, discussions on research occurred only at the graduate level, when individuals were interested in pursuing an academic career. Elucidating that if medical institutions in Morocco, established a structured research program, the vision of faculty members' role would be clearer. Undergraduates would become familiar seeing research across all departments, and a curiosity and interest in research would probably start from within. A faculty member mentioned:

"If you try to ask a sample of undergraduate students, how many times they encountered research topics within their internships! I think you'll get the idea that undergraduates aren't quietly exposed to research." [Participant 15, Male, Medicine]

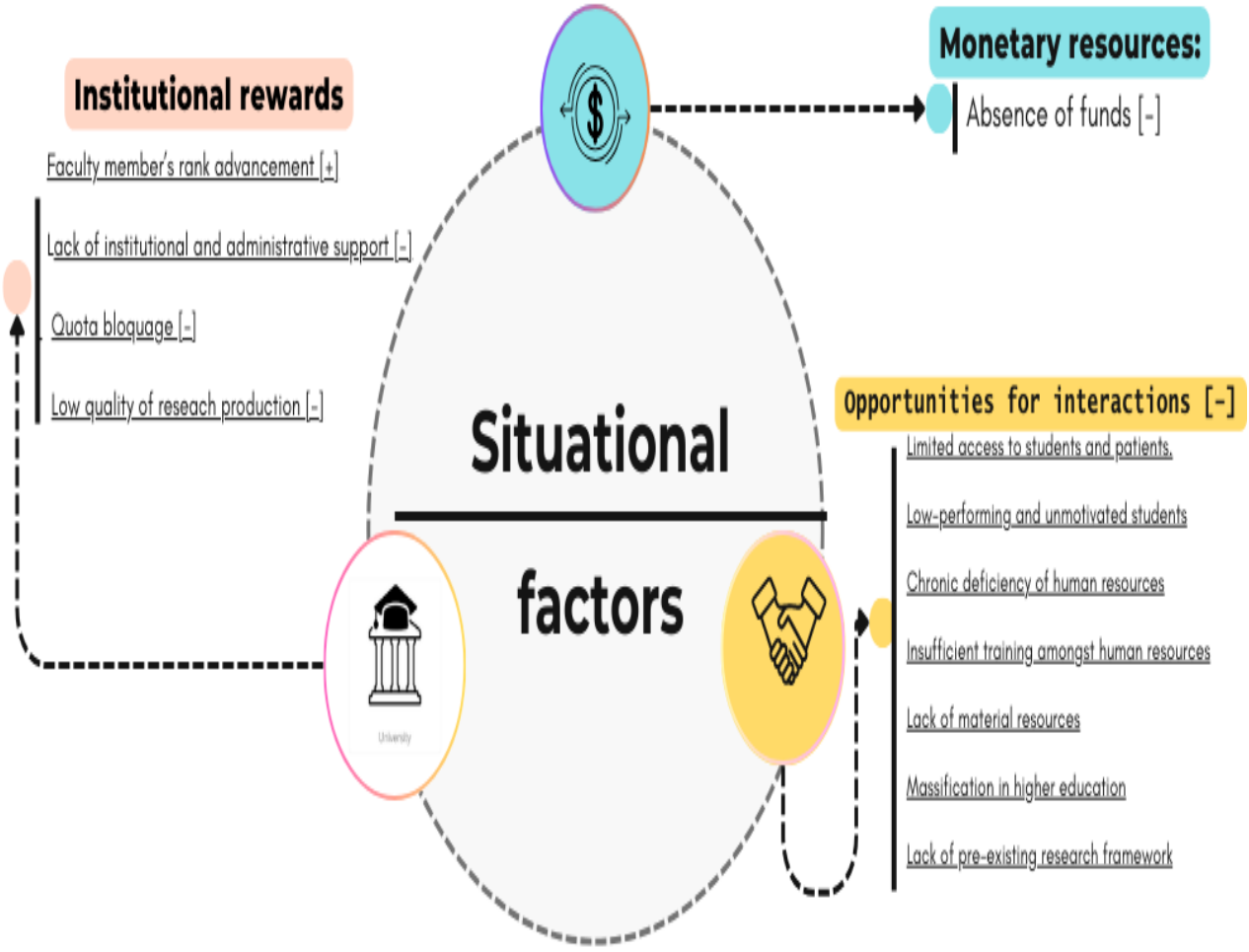


Figure 3:Situational factors of Moroccan undergraduate medical research

This mind map mind-map illustrates the 3 domains constituting the situational factors that influence the motivation of faculty members towards URE: opportunities for interaction, institutional rewards and monetary resources. Each domain was attributed with a (-) minus symbol, reflecting that almost all statements of faculty members influenced negatively their motivation. Only the rank advancement had a positive (+) influence in motivating faculty members to engage in such experiences.

4. Dispositional factors:

Perception around undergraduate medical reached beyond the benefits and costs in involving undergraduates in faculty members' research project. And Included perceptions around the relevance of URE in medical curriculum, the outcomes and background of their interactions with medical students. Demonstrating their intrinsic beliefs.

1. Organizational Citizenship Behavior (OCB)

Results in OCB were categorized into 5 groups: altruism, consciousness, sportsmanship, courtesy and civic virtue. These 5 domains of OCB

1.1 Altruism

Results demonstrated that benefits weren't restricted to faculty members, but impacted others: Medical students and organizations. Those altruistic actions were divided into two categories: organizational citizenship behaviors forwarded towards individuals (OCBI), in our context, those individuals were the undergraduate medical students who engaged in research. The second altruistic behavior was the organizational citizenship behavior forwarded towards the organization (OCBO), where both society and medical institutions were impacted positively with the occurrence of effective URE.

a. OCBI: Undergraduate medical students' benefits

All faculty members, with no exception expressed at least one benefit of URE in medicine for undergraduate medical students. The results showed that benefits for medical students might even outweigh those for faculty members, emphasizing on numerous benefits. We categorized these benefits into benefits in the short term, and benefits in the long terms. Benefits in the short term, were the 'soft skills' and 'hard skills' that undergraduates acquired thanks to their involvement, contributing in their personality development and improving their academic outcomes.

At thesis phase and further research opportunities, medical students were more likely to conduct research work at ease, given their previous undergraduate research experiences which leaded them to capitalize a sufficient research background, facilitating any upcoming research opportunity. In the long term, those who were exposed to undergraduate medical research experienced mind-

openness in career-pursuit at graduate and post-graduate levels. Sometimes, these undergraduates accessed to international opportunities, in either communicating research at the international level or better when pursuing career-related opportunities abroad.

Soft skills. Eight faculty members stated that undergraduates were shaped through these opportunities by working in teams and learning how to communicate within. Also, they developed autonomy in thinking and accomplishing new tasks by themselves. And while research required thinking, they developed critical thinking. Finally, research fostered mind-openness to accept and embrace new experiences and career opportunities. A faculty member said:

"And I think that the main gain for him [undergraduate students], is that he will develop a critical mindset." [Participant 15, Male, Medicine]

Hard skills: Eighteen faculty members expressed that mastering hard skills through undergraduate medical research experience was one of the biggest benefits for medical students. Among these skills, 11 mentioned research methodology, others reported acquiring the "Evidence-Based-Medicine" practice, enhancing their clinical performance by relaying their daily practice on new clinical-guidelines derived from research results.

Only one faculty member reported the "Erudition", describing it as the highest form of achievement for a future general practitioner, through these experiences. A faculty member said:

"This knowledge is acquired through research-conduct. And research itself is among the means that contribute to expanding our knowledge. it's only by conducting research that one becomes an expert, scholar and erudite person and so on. Therefore, it is a means to enhance and develop one's personality, their soft skills and hard skills." [Participant 16, Female, Science]

Facilitation of upcoming research work.

Undergraduate medical students who were engaged early in research, became familiar with research tools and methodology. Consequently, at the medical thesis phase, breaking down study

steps and research methodology into paragraphs became much easier, compared to those with no previous undergraduate research experience.

Plus, undergraduate medical students secured their thesis topics when faculty members suggested to adopt the current research as undergraduates' upcoming thesis topic. In the long term, those who became medical resident doctors or general practitioners (GP) would be better prepared for any research collaboration or case-report publication. A faculty member stated:

"If he had been involved during the early years of medical studies, I'm sure that the thesis topics he would produce, or the research he would conduct, would make his work easier and generally improve the quality of scientific output at the faculty level." [Participant 7, Male, Medicine]

Access to new opportunities:

Three faculty members believed that undergraduate medical students' engagement in research activities enhanced their C.V and provided mind-openness and access to pursue careers, at graduate level, either locally or abroad. These experiences influenced significantly their career choice, where undergraduates found themselves choosing research-oriented-careers, at graduate levels. A faculty member said:

"For the student, this opens up opportunities, or we can call it careers. we could say that, beyond a purely practical-clinical path, a career in scientific research becomes possible, which fosters a certain openness of mind" [Participant 14, Male, Medicine]

b. OCBO: Benefits towards organizations

Results analysis generated perceptions on positive outcomes for both society and medical institutions, all through Undergraduate Medical Research Experiences.

Benefits for the institution

Nine participants expressed how medical students' engagement in research, at early stages, would improve the quality of thesis work. Plus, if opportunities for thesis publication were provided, a revolution in scientific research output would occur not only in terms of number, but also in terms of quality. One faculty member mentioned how the involvement of undergraduates, who mostly

belonged to their medical faculty and institution, would enhance the faculty's visibility in upcoming publications.

In the long term, integrating URE through the medical curriculum would enhance medical studies in Morocco, improving their rankings at the national and international level. A faculty member said:

"Indeed, this will help advance both the academic level of universities and that of students, as well as improve the ranking of medical education in Morocco. This is how we will encourage students to conduct high-quality research suitable for publication in indexed journals." [Participant 12, Male, Medicine]

Benefits for the society

Only 2 participants emphasized the positive impact of undergraduate medical research experiences on the society. Elucidating that when undergraduates applied the knowledge they received through these experiences, for the benefit of society, such as spreading awareness at high schools through campaigns. Or by forwarding some research funds to provide medication to the targeted population of research. All of these community actions contributed in promoting healthcare, strengthening disease prevention and providing close access to healthcare at the community level. A participant said:

"*So, this could also serve as a way to highlight and give value to the actions they undertake, which I would say are of great benefit to the community and therefore to both the individual and society."*

[Participant 5, Male, Medicine]

1.2 Consciousness

a. Relevance of undergraduate medical research experiences

All 22 participants provided their insights towards the engagement of undergraduate medical students in research experiences. A party agreed on the relevance of such early exposure and how it was crucial in undergraduates' medical training based on multiple arguments; they emphasized the mutual benefits for society, faculty members and undergraduates; especially that early exposure to research had already proven to be fruitful within non-medical institutions. Therefore,

faculty members encouraged such initiation from medical institutions in Morocco. However, another group of participants was doubtful on the significance of such programs, questioning medical students' abilities and potentials, emphasizing that medical students' first research production should be none other than the thesis project. A faculty member said:

"Me, when I compare with science students, we start supervising their work as early as their end-of study project, in the third year. And we continue to guide even during their Master's and PhD. … I believe the same approach should be applied to our undergraduate medical students. we who should be more actively involved in research. Moreover, at another level, some students may even pursue a career of research" [Participant 2, Female, Medicine]

b. Research as a must required competence of a future general practitioner

Moreover, 15 participants addressed the competencies that future General Practitioners should master. All agreed on research skills as crucial and complementary elements nowadays. Undoubtedly, besides other basic foundations taught in the medical curriculum. The most frequently reported research skills were: "Evidence-Based-Medicine" practice, scientific writing and authorship. Describing how it was unfortunate that most medical curricula in Morocco focused on primary care, developing consequently robotic-prescribers instead of general practitioners (GP) whose attitudes were well backed up with scientific-evidence and new clinical guidelines, as medicine constantly evolves.

Only one faculty member described research as an extra element with no significance or basic foundation, since they perceived research as an exclusive skill of faculty members.

"Their priority (undergraduate medical students) is to train and become good doctors. and research comes second. he cannot engage in research if he doesn't first master the job as a doctor. First, they must be a doctor — then, a researcher." [Participant 15, Male, Medicine]

c. Sense of duty

Faculty members admitted their responsibility towards motivating, guiding and creating opportunities for their medical students in undergraduate research. Revealing that research was

not an option but rather a mandated responsibility, as a portion of their salary was allocated to research-related duties. Plus, some undergraduate medical students possessed hidden talents that needed to be discovered and unlocked through these opportunities, admitting that undergraduate medical students had, at least, a theoretical foundation in research, which could serve as a strong starting point to their involvement.

"This represents an extra workload for faculty members. However, a faculty member who is genuinely committed to carry out research projects does not work alone; they work within a team. And those who are convinced of the importance in involving students in research know very well that research requires sacrifice, dedicated effort. It's all about consistency." [Participant 5, Male, Medicine]

d. Research-Based-Learning

Others employed research as a moment to deliver knowledge. Believing that 'Research-Based-Learning' was more efficient compared to courses delivered at faculty.

"It could also be considered, perhaps, a learning opportunity under research framework. research is used as a means to teach, whether in the field of clinical care or in research itself—because it provides an opportunity for learning." [Participant 15, Male, Medicine]

1.3 Sportsmanship

Faculty members admitted that no excuse should prevent them from engaging in Undergraduate Research and research in general. Revealing that even in the absence of some resources, research could still be conducted. An interviewee stated:

"We must always remain optimistic, especially with undergraduate students; perhaps the more we involve them in research, the more we gain. When there is a group where everyone contributes significantly and we apply a certain pressure on academics and people who are responsible, the purpose is achieved—rather than remaining inactive and always waiting for someone else to come to our rescue." [Participant 16, Female, Science]

Conversely, what prevented faculty members from engaging undergraduates in research was the lack in the simple idea of asking them to engage in some tasks related to research. Given the continuous undergraduates' flow in most departments, faculty members could have asked some, to accomplish a task or two. This reflected the absence of the undergraduate research conception within faculty members. This aligned with a faculty member when he mentioned:

"If we truly want to implement the habit of involving undergraduate students within the department's research projects, they will be initiated in terms of research. The problem is that it never occurs to us to involve them. In general, when a department conducts research, it is usually the resident doctors who conduct it or students during their thesis. ... And we forget to involve second-cycle students. We should... They spend two months in the department, which means they could analyze and process the available case files." [Participant 1, Female, Medicine]

1.4 Courtesy

Twelve faculty members agreed on rewarding undergraduate medical research efforts through their involvement in research. Explaining that these undergraduates must be distinguished from other undergraduates who didn't participate and dedicate their time to research. The most frequent reward was authorship, by listing the undergraduate medical students' names among other authors. Some suggested delivering certificates, electronic gadgets or books. Overall, it was necessary to honor and reflect one's efforts with some kind of acknowledgment. Although one faculty member expressed their disapproval of monetary rewards. Explaining the controversial side of it. But a scientific recognition was preferred. A faculty member said:

"It is essential to provide a kind of motivation. But if he (undergraduate) writes an article and in the end, he is seen as equal to the undergraduate student who has done nothing, that's not fair. Do you see it!" [Participant 20, Female, Medicine]

1.5 Civic Virtue

The impact of research on healthcare advancement was evident to 12 faculty members, when they agreed that the ultimate goal of working in research, was to support 'evidence-based-medicine' practice. Thereby, the improvement of patient's care. A faculty member added:

"A researcher, he changes the life of a million of patients but a clinician he changes the life of on patient. " [Participant 1, Female, Medicine]

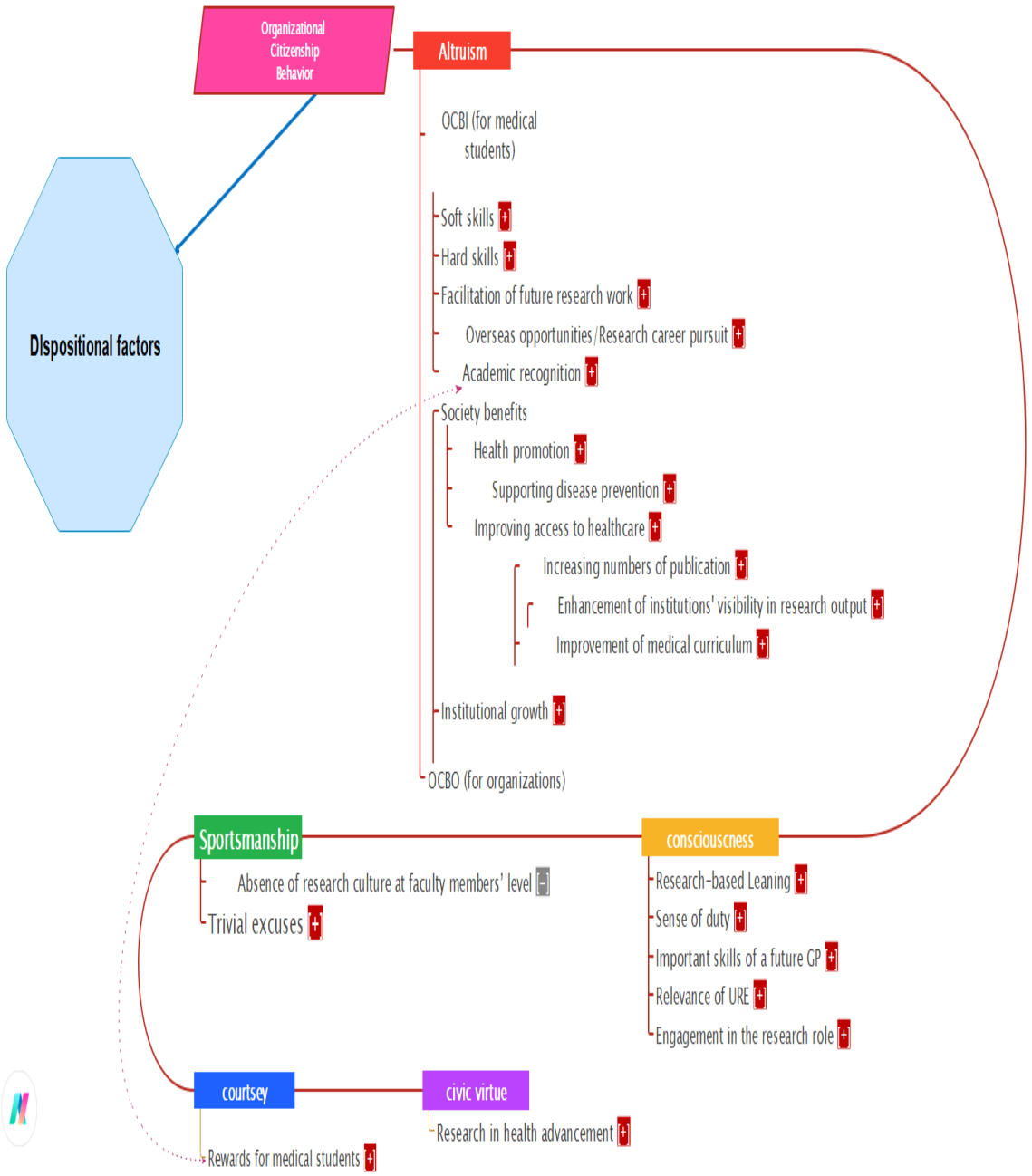


Figure 4: Dispositional factors according to Organizational citizenship behavior, influencing faculty members' UMRE

This figure demonstrates the 5 categories of the organizational Citizenship Behavior (OCB), which were altruism, consciousness, sportsmanship, courtesy and civic virtue. Firstly, altruism was divided into faculty altruism towards medical students, where benefits were one-way towards undergraduates. And faculty altruism towards organizations, where faculty members believed that

engaging in undergraduate research would benefit the society and the medical institutions in Morocco. All other categories were stated positively by faculty members, except the research culture among faculty members, that would hinder the sportsmanship spirit within participants and influence them negatively by the non-involvement of medical students in faculty research projects.

III. Testing for Theory Alignment

Some of the emerging themes couldn't fit totally in the current conceptual framework. We used two other psychological theories that are crosscutting with the OCB and other previous themes of the conceptual framework. The SCCT (the self-cognitive career theory), which explains the actions of individuals through motivations and career development. The SCCT is explained by 3 main domains, (self-efficacy) where faculty members base their perception on their own beliefs of being efficient in Undergraduate Research Experience (URE), they either perceive themselves succeeding in these experiences or the inverse. The (Outcome expectations) which are the results of their engagement of URE could benefit them or hinder their engagement. Lastly, the goal performance and the goal choice, determine the purpose faculty members seek these experiences. The SCT, self-determination theory, consists of three parameters that broadly explain individuals' action. When they feel connected, they engage (relatedness), when faculty members initiate such experience is because their willingness guided them (autonomy) and when they strongly felt confident in their qualifications (competence).

1. Self-cognitive-career theory (SCCT)

1.1 Self-efficacy

More than half of the participants reported positive mentoring experiences, personal experiences or observed experiences in other departments and countries, where undergraduates contributed to research work. Conversely, the majority of faculty members reported challenges related to scheduling time for undergraduate medical students and finding a consensus time suitable to both undergraduates and faculty members. Faculty members Believed that efficient research required sustained and full-time dedication. Which is absent in their context.

On the other hand, one faculty member reported that he declined a meta-analysis project, suggested initially by a medical student. Faculty member reported that they couldn't meet up to the medical student's expectations, since they lacked skills around meta-analysis specifically. For this purpose, participants solicited institutions to organize ongoing training for the benefit of

faculty members, to enhance their preparedness and self-confidence in succeeding in upcoming undergraduate mentoring experiences. A faculty member said:

"So yes, exactly. We need to involve assistant professors and resident doctors, because faculty members alone cannot handle all of this by themselves. They are already overwhelmed with clinical duties and supervision, and assigning them the additional responsibility of mentoring undergraduate students in research is not easy." [Participant 20, Female, Medicine]

Social persuasion

- The current situation of medical research in Morocco influenced the perception of faculty members on the conceptualization of undergraduate medical research experiences.

  Few (6) faculty members assessed the current quality of Moroccan research production, including thesis work. They described it as below average. Some believed that most theses didn't contribute in advancing much at the practical level. According to them, undergraduate medical students labeled thesis as a formality, before the obtention of their degree as doctors in General Medicine.

  Therefore, students showed disinterest in conducting efficient research work. This impacted faculty members' credibility, influencing their vision on the upcoming URE in medicine, which could certainly put their credibility, once again, in a more vulnerable position. Exceptions were noted when a few medical students still managed to produce better research work. A faculty member added:

  "It is a disaster what we find as results, analysis and data. and this mitigates the credibility of the entire sector." [Participant 4, Female, Science]

- The low quality in Moroccan medical research output impacted highly on medical institutions' rankings. Three faculty members explained the low ranking, by the mediocre investment towards research in Morocco and the language barrier, where most published articles must have been in the English language. A participant said:

"We're always disappointed by the ranking of Moroccan universities. Unfortunately, the only thing that sets us apart from others is the language. The lack of publications in English. I hope future generations will start publishing in English." *[Participant 12, Male, Medicine]*

Faculty members' hesitations towards UMRE were previously explained by the mediocre investment of undergraduates in research and thesis work. Which could put faculty members' credibility in question.

- Meanwhile, more than half of the participants explained that the idea of simply asking undergraduates to engage in research never occurred to. them. The lack of this unfamiliar act couldn't reflect more than the depth of the absence of research cultural roots in our Moroccan institutions. Suggesting that research was never a priority for faculty members, nor for undergraduate medical students. A faculty member said:

  "The difficulty lies firstly at the level of our conception, in our beliefs and convictions, faculty members." *[Participant 7, Male, Medicine]*

- As for institutions. What made Faculty members more reluctant about undergraduate medical research was the absence of support from medical institutions. Since, they were supposed to contribute in the advancement of medical research in Morocco. This lack of support was illustrated by the lack of revisions of undergraduates' manuscripts. Secondly, by the archives of thesis works in library instead of financially supporting their publication. lastly, by the lack of minimal funds to cover research' costs. From laboratory analysis, accessing software and programs useful for the research work. A faculty member said:

  "*There's also a general lack of interest from the administration when it comes to faculty career advancement. As for research, it mostly depends on individual efforts from those who are genuinely interested in it*." [Participant 12, Male, Medicine]

1.2 Outcomes expectation

As already mentioned, faculty members expected various outcomes benefits from undergraduate medical research, such as enhancing their professional growth and requiring new hard skills by continuously conducting research.

1.3 Goals

Faculty members admitted that their goal in engaging in such experiences, was publication of more articles, recognized in his professional portfolio.

Ultimately, achieving scholarly excellence through advancement in ranking and cultivating experiences and expertise through mentoring medical students through undergraduate medical research experiences.

A faculty member added:

"*Conducting research projects, it will permit a professional development. Because, I would say, there would be advancement to his knowledge and to the scientific situation.*" [Participant 9, Female, Medicine]

2. Self-Determination Theory (SDT)

2.1 Autonomy

Some faculty members expressed a sense of fulfilment and self-satisfaction they felt by engaging undergraduate medical students through research, the moment they completed their research project. Another faculty member, added that the only moment they felt professionally satisfied was through the improvement of their patient's health condition and through undergraduate medical research. Otherwise, nothing eased their passion for research better than research itself. On top of that, they enjoyed the dynamism and the youthful energy brought by undergraduate medical students. A participant stated:

"Already engaging in research projects contributes to professional growth, both in terms of knowledge and also in the scientific community." [Participant 9, Female, Medicine]

2.2 Competence

Faculty members didn't feel completely ready to mentor undergraduate medical students in research, for two reasons. First, they solicitated institutions for a continuous and long-term training for all human resources, including resident doctors and faculty members in their early careers, in order to be fully prepared for any upcoming opportunity of undergraduate research mentoring experiences. Secondly, they seeked help from 'clinical research center' to train students about research process, as they reported they were much more qualified. A faculty member said:

"Last time, an undergraduate student wanted to conduct a meta-analysis within our department... I was surprised by that undergraduate student. He had taken courses in meta-analysis and he was familiar with statistical methods and a lot of other things. I must admit, I don't know much about it. Well, he finished enrolling, and we didn't have the time to develop a project." [Participant 15, Male, Medicine]

2.3 Relatedness

No results emerged aligning to the sense of belonging and relatedness from faculty members' perspective around UMRE.

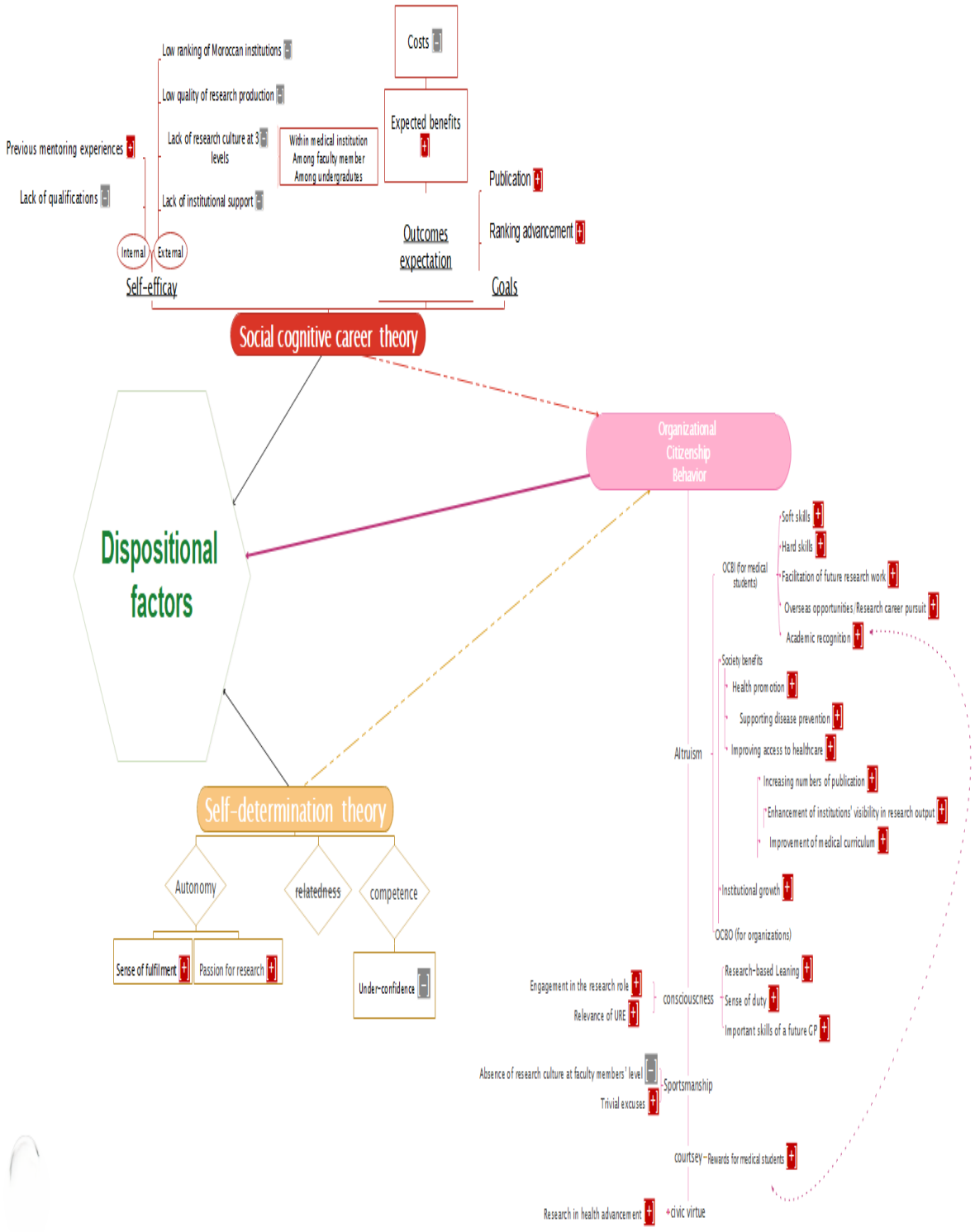


Figure 5:Interactions between SCCT, SCT and OCB all influencing dispositional factors of faculty members' motivation towards undergraduate medical research experience

This mind-map contains the 3 dimensions of dispositional factors we adopted to explain the remaining codes. In fact, the Social Cognitive Career Theory (SCCT)components (self-efficacy, outcomes expected and goals), along with the SDT (autonomy and competence) were influencing, to some extent, the 5 foundations of OCB; meaning when faculty members feel self-efficient and autonomous in making decisions, they became more likely motivated to engage in undergraduate medical research under the framework of OCB. (e.g., they become more courteous, altruistic)

IV. Strategies of implementation:

One question for faculty members during the interview, was the feasibility of such experiences if ever they were to be established in our Moroccan context. This generated a whole new theme around strategies of implementation, demonstrating faculty members vision of any upcoming formal or informal experiences. We classified these results into 8 sub-themes.

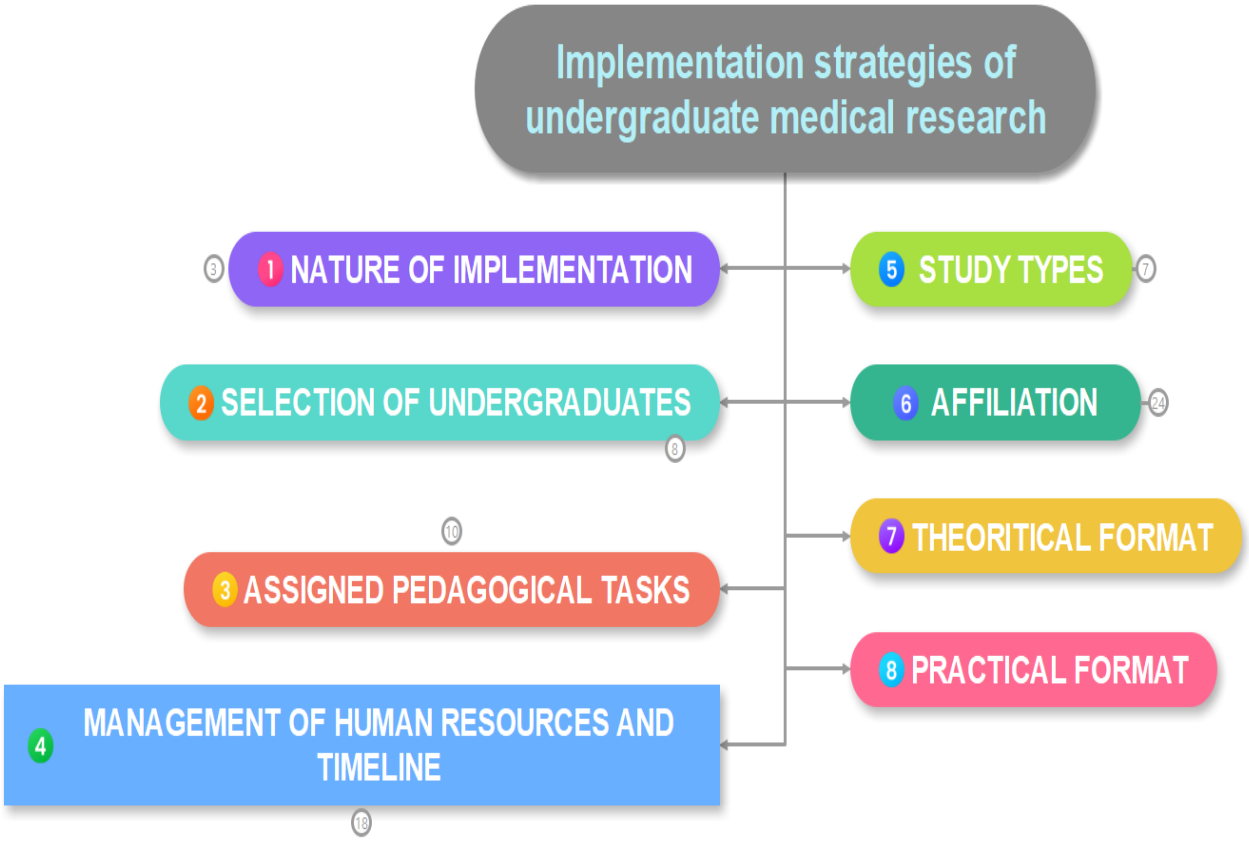


Figure 6:Eight steps to implement the undergraduate medical research in medial curriculum

Faculty members debated on the feasibility of engaging undergraduate medical students in research, almost all faculty members agreed that these experiences could work out either starting from the 1st year or, even better, at the 3rd year. But the success of these opportunities depended on certain conditions. For instance, students should be given small tasks which were aligned with their area of strength and interests. One participant doubted undergraduates' abilities and questioned their insufficient theoretical background, which could affect the success of these initiatives. A faculty member said:

"Of course, it's practical (undergraduate medical research). Yes, because when we have research topics, there are different levels of involvement. First- and second-cycle students can definitely

collaborate as secondary investigators in research projects — they have sufficient scientific background and can certainly contribute." [Participant 9, Female, Medicine]

Faculty members recognized the small and main changes that were required to be seeken; for instance, maintaining affiliation with the department where undergraduate research was first conceptualized. Knowing that undergraduates enroll in other departments. Plus, if a few undergraduate medical students had the chance to be involved over others who couldn't access it, it could create inequalities in academic experiences, therefore in their professional skills. A faculty member satted:

"So, it is always difficult to implement a new educational approach. Of course, motivation, time, and often the availability of a space for training in medical and scientific." [Participant 14, Male, Medicine]

The improper arrangement of research-based courses. One participant highlighted the disconnection between the theoretical research courses provided during the first year of medical studies and the real engagement in research during the last year (e.g., medical thesis). The 2nd faculty member disagreed on involving students in research until the 5th year, based on ethical concerns, as students would be exposed to all population Data through their research, while ethics weren't taught until the fifth year. A faculty member said:

"Probably, the timing isn't appropriate, since they (undergraduates) will study this (theoretical research course) in the first year, but won't use it until their 7th year." [Participant 2, Female, Medicine]

Faculty members were asked about the practical sides of undergraduate medical research, if ever efforts were put together, will these initiatives succeed, or if they can be practical and real in our Moroccan context. Responses varied widely, and generated suggestions that were organized as strategies of implementation.

1. Nature of implementation:

Perceptions about the nature of the implementation of undergraduate medical students were variable. In fact, 9 faculty members supported the mandatory approach, believing it ensured equal opportunities and skills-balancing among all undergraduates. Moreover, they supported the implementation at the institutional level rather than ministerial control, allowing universities to shape these programs according to their own perspectives.

Meanwhile, 10 participants were strongly against forcing undergraduates into research, based on previous experiences where forcing something against students' willingness never brought the expected outcomes. Plus, massification in medical schools should be considered. Therefore, a selection system was the best approach to select students who were suited to engage.

Two other faculty members expressed no clear preference for either approach. Instead, they recommended a progressive implementation, where the transition from volunteering to involving everyone should occur once the program has reached optimal refinement and enhancement.

"Yes, probably at the beginning, it needs to be volunteered. After that, and gradually, it will be developed until it becomes mandatory. This approach will permit an evaluation of undergraduates' perception also of their engagement within these research studies." [Participant 9, Female, Medicine]

2. Selection of undergraduate medical students:

As some faculty members preferred the selection approach in recruiting undergraduates. This approach was justified by the fact that engagement of some particular undergraduate medical students over others, would definitely deflect the risk of research project failure. Therefore, specific criteria were claimed to be present in undergraduates as following: genuine interest in research, intrinsic motivation for research and confidence in balancing the duality on both academic and research responsibilities.

As for the timing, some suggested the identification to take place at 3rd year when students started their clinical rotations. Others, revealed that identification would be easier with fewer students, in

particular at lab work, where 3 to 4 undergraduates should be spotted and added to a group of undergraduates, which will create interactions between newcomers and undergraduate students with previous experience, fostering a peer-supported supervision. As some faculty members referred to as "the training of the trainers".

A faculty member added:

"It's true that identifying students who have a natural inclination for research is a good thing. Or those who are highly motivated and eager to contribute and make a meaningful impact." [Participant 5, Male, Medicine]

3. Study types:

Only 6 faculty members opened up discussion on the type of studies in which they might involve undergraduates. Most of them perceived 'case-report' and 'case-series' as simple on the practical side. Meanwhile, others, considering their departmental context and their field of expertise, suggested engaging undergraduates through clinical trials or in their current meta-analysis research project.

A faculty member added:

"They can conduct observational research work." [Participant 2, Female, Medicine]

4. Nature of pedagogical assigned task for undergraduate medical students

Eighteen faculty members proposed different tasks that could be attributed to undergraduate medical students through research, emphasizing that these missions should be assigned wisely, according to students' motivations, strengths and interests. Data collection was in the top list, recommended by 11 participants, followed by the literature review and scientific writing, suggested respectively by 8 and 5 faculty members. Other suggestions included undergraduates to assist with different steps of the research process.

A faculty member said:

"There's already the difficulty in collecting data and all that is anonymous. All of these tasks, I think that an undergraduate could well handle it." [Participant 1, Female, Science]

5. Management of human resources and research timeline

Among 7 faculty members, some encouraged to select mentors whose sole responsibility would be research, alongside the guidance of undergraduate medical students through these opportunities. These dedicated faculty needed to have their entire focus on research projects, the only way to bring effective changes and new discoveries to the medical field.

One faculty member sensed this unrealistic side from "the dedicated Mentors". And, they suggested selecting faculty members based on their motivational level and competencies. However, some responsibilities were to be cleared up from their schedules. For instance, the academic responsibilities related to course delivery at the faculty. A participant said:

"So, research for faculty members, when we conduct research, the research is required to do nothing but research. He (faculty members) can deliver some courses, like what faculty members in science fields do, they teach a few courses, but the majority of their time is dedicated to research." [Participant 16, Female, Science]

Plus, extending rotation durations would allow both faculty members and undergraduates a decent time to meet academic objectives, including research. On top of that, students selected to undergo research, must maintain contact with their assigned research team at a frequency of 1-2 times per week, after completing their rotation at that department.

To achieve publications, the research team would be granted a 2-4 year deadline. This timeline reflected how institutions perceived not only that research required time to mature and progress, but also to dedicate sufficient time for undergraduates to grasp new knowledge and master essential skills.

A participant mentioned:

"Yes, we can always continue working, perhaps coming back one day every three days or once a week. This way, the work can keep progressing over two or three years, and at some point, they'll realize that their project is taking shape and moving forward, and so are they." [Participant 5, Male, Medicine]

6. Affiliation to a research team

The structure of the team where undergraduates could get affiliated with must be composed of resident doctors, biologists, and professors, with clearly pre-defined roles. In order to facilitate this integration, projects should be pre-established and supervised by dedicated faculty members. Plus, a constant affiliation with a specific department or laboratory can ensure continuity and alignment with the curriculum and other rotations. Interdisciplinary collaboration and peer supervision enhanced the learning experience, while the long-term support enables undergraduate students to accomplish their projects and publish their findings.

A faculty member said:

"Yes, and that's why I proposed de maintain a kind of connection and affiliation to the department. It is like this how they are going to go back and forth from the department and work continuously on research." [Participant 5, Male, Medicine]

7. Practical strategies

Numerous suggestions were made regarding the practical implementation of undergraduate medical research. Some proposals were thesis-oriented, where faculty members suggested a structured and supportive program starting earlier at the 1st year, dedicated to support undergraduates through their theses work at their final year, by mentoring student in research tools, in order to capitalize the necessary skills by the time they reached the thesis phase. Especially, considering the duration of medical studies that has been shortened to 6 years. Conversely, others were firm about their opinions on only opening opportunities to undergraduates

through research, and no publication by undergraduates should be allowed before the completion of thesis.

Other proposals included engaging undergraduates, starting their clinical enrollment in the third year; One faculty member proposed replacing one course dedicated to a certain department-course, by an introductory research course, a way of opening up research opportunities to undergraduates. Others proposed engaging undergraduates in medical caravan as a valuable opportunity for community research exposure.

The arrangement of undergraduates ranged from individual work to teamwork, where students' composition must vary in terms of years, like a dyadic model pairing an undergraduate in the 4th year with a medical student in their 6th year. Or a team composed of 3-4 undergraduates working under the mentors' supervision.

Regardless of the organization of teams, it was agreed that a presentation must occur at the end of the year, where students present their work. Including the research methodology, Results.

Some suggestions were about lists of research topics connected with a faculty member, where students can easily get access to, through a platform and choose freely to engage according to their interests.

A faculty member said:

"These mini-projects, when undergraduates are going to accomplish them, it's going to be like an accumulated experience beneficial for them to use during their work on medical thesis." [Participant 1, Female, Science]

8. Reinforcement of the theoretical research background

Prior to practically engage undergraduates in research, undergraduate medical students must acquire and reinforce their theoretical research background. Participants suggested the establishment of courses to learn the research process, with clear objectives well pronounced by

faculty members. For example, faculty members must explain that academic courses were based already on research results.

Some suggested the organization of seminars, conferences and workshops where students could learn some research skills. These faculty members and undergraduates would communicate new protocols or articles brought by undergraduates to discuss the methodology used and the level of significance of the research' results.

Others proposed "research-based courses" according to undergraduates' level in medical studies. To the extent that courses delivered to 1st year wouldn't be similar to those delivered to 3rd year. A faculty member said:

"Honestly, the radical solution would be to postpone the teaching of research skills until the fifth year. At that point, they could relay the theoretical background immediately to the practical side, when they start their research work on medical thesis." [Participant 8, Male, Medicine]

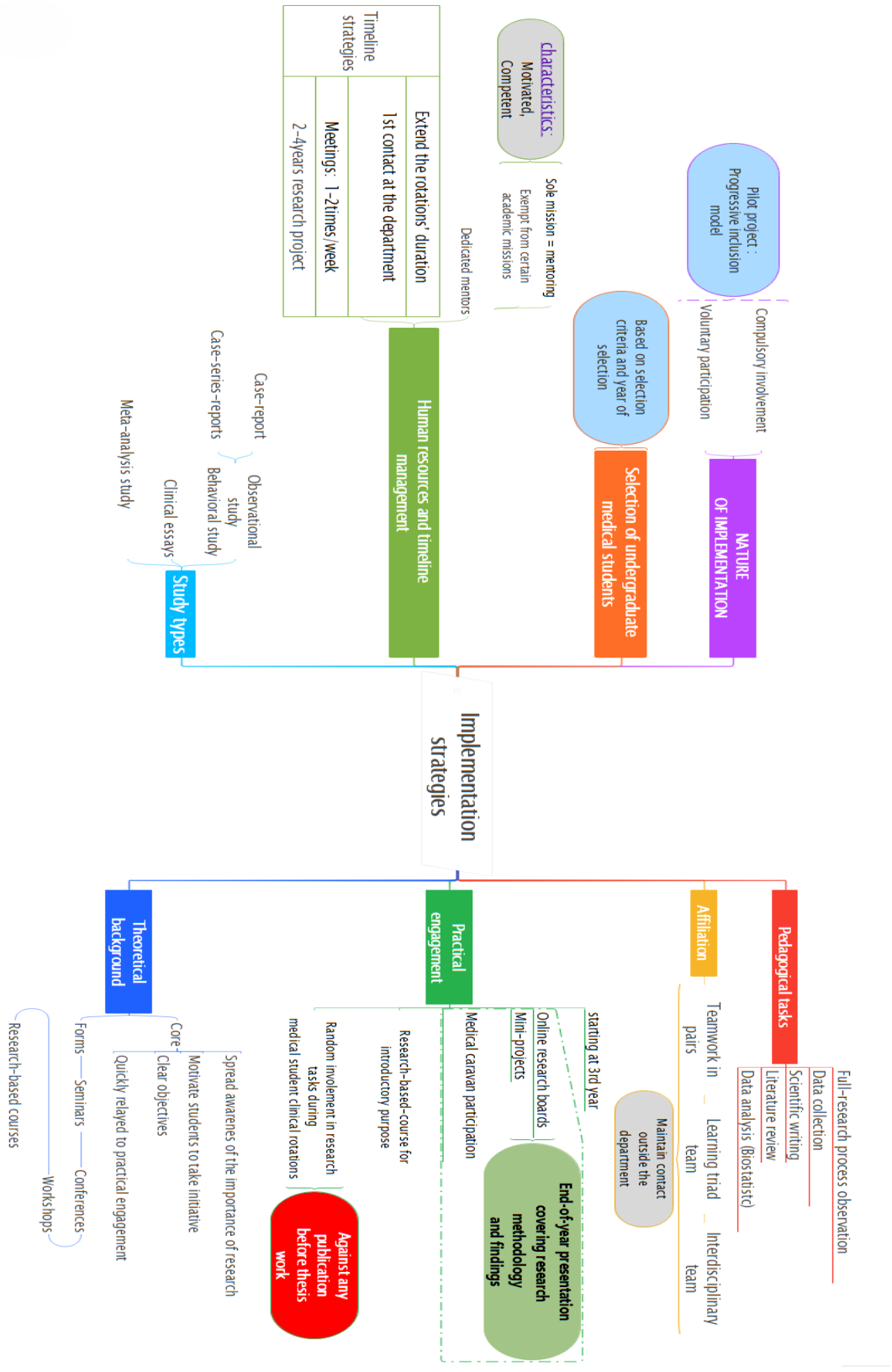


Figure 7: Summary of implementation strategies

Faculty members suggested terms to implement undergraduate medical research. Suggestions varied, but the one strategy was maintained. Before any engagement, a theoretical background was vital, it consists in reinforcing previous courses related to research by setting clear objectives of spreading awareness about the importance of evidence-based-medicine acquired by conducting research, and diversifying theoretical learning forms (e.g., seminars, conferences, workshops).

What follows depends on the strategy of implementation; either compulsory involving everyone or a voluntary engagement that relies on selection criteria and year of involvement (e.g., first year, third year). Some even suggested a progressive inclusion model, where few undergraduates could engage at first, and gradually as enhancements and modifications are made on these programs based on faculty and undergraduates' feedback, involvement will eventually accommodate the large number of undergraduate medical students per class.

Mentors could either be dedicated mentors, who were exclusively assigned to mentor research, or faculty members who were exempted from other academic duties to dedicate their time to research mentoring. First contact with undergraduates would take place at the faculty members' respective department, and undergraduates will stay affiliated to this department after enrolment completion within the department where their research was conceptualized. Meetings would be adjusted weekly, according to both faculty and undergraduates' free time, and deadlines were set at the beginning.

DISCUSSION

Summary of main results

Our qualitative study was conducted to explore faculty members' perceptions around undergraduate medical research. Following Morales' conceptual framework, we summarized our results as demonstrated in the figure below. Morales et al (1) focused on constraints and enablers that significantly influence the motivation of faculty members. We present the results as follows: perceptions were broken down into perceived benefits and perceived challenges, in addition to the Demographic characteristics and experiences from previous undergraduate research.

Each domain in the figure below describes faculty members' perceptions; each perception is marked with a plus (+) or minus (-) to indicate positive or negative views, representing perceived benefits and perceived challenges, respectively. Faculty members who had previous mentorship experiences or observed these activities in other departments perceive their experiences as a positive background, shaping motivation for any upcoming undergraduate medical research opportunity.

Additionally, female faculty members, as well as those in mid-career and late-career stages, and faculty who belong to medical disciplines had more experience in undergraduate medical research. Perceptions on benefits and challenges were classified into 3 psychological theories and behaviors, which were the social exchange theory, which was categorized into expected costs and expected benefits, the dispositional factors, and the situational factors.

The situational factors were perceived as challenges in both monetary resources and opportunities for interactions. The rank advancement was perceived as the sole benefit for faculty members, and all factors related to institutional rewards were reported as perceived challenges. Further, the dispositional factors were divided into three main theories. The OCB, which stands for Organizational Citizenship Behavior, is reported as perceived benefits, except for the lack of research culture among faculty members (-).

Faculty members were motivated to contribute to the professional development of undergraduates (altruism), they would devote their time to fulfill their duties as faculty members in both teaching and delivering knowledge through undergraduate medical research exposure (consciousness).

Faculty members express fairness in demanding rewards for the effort of undergraduates (courtesy), and accepted to conduct undergraduate medical research even in the presence of various shortcomings (Sportsmanship). Lastly, faculty members perceived that undergraduate medical research was conducted to enhance patient care and promote the healthcare system (civic virtue).

Concerning the social cognitive-career theory, faculty members perceived themselves mainly as non-efficacious in conducting undergraduate medical research. This belief of self-efficacy was supported by 4 perceived challenges and one perceived benefit. The previous mentoring experiences, as they were successful, were perceived as positive. And the line, on the mind-map above, connecting self-efficacy and the previous mentoring experiences, explains the connection between the two elements.

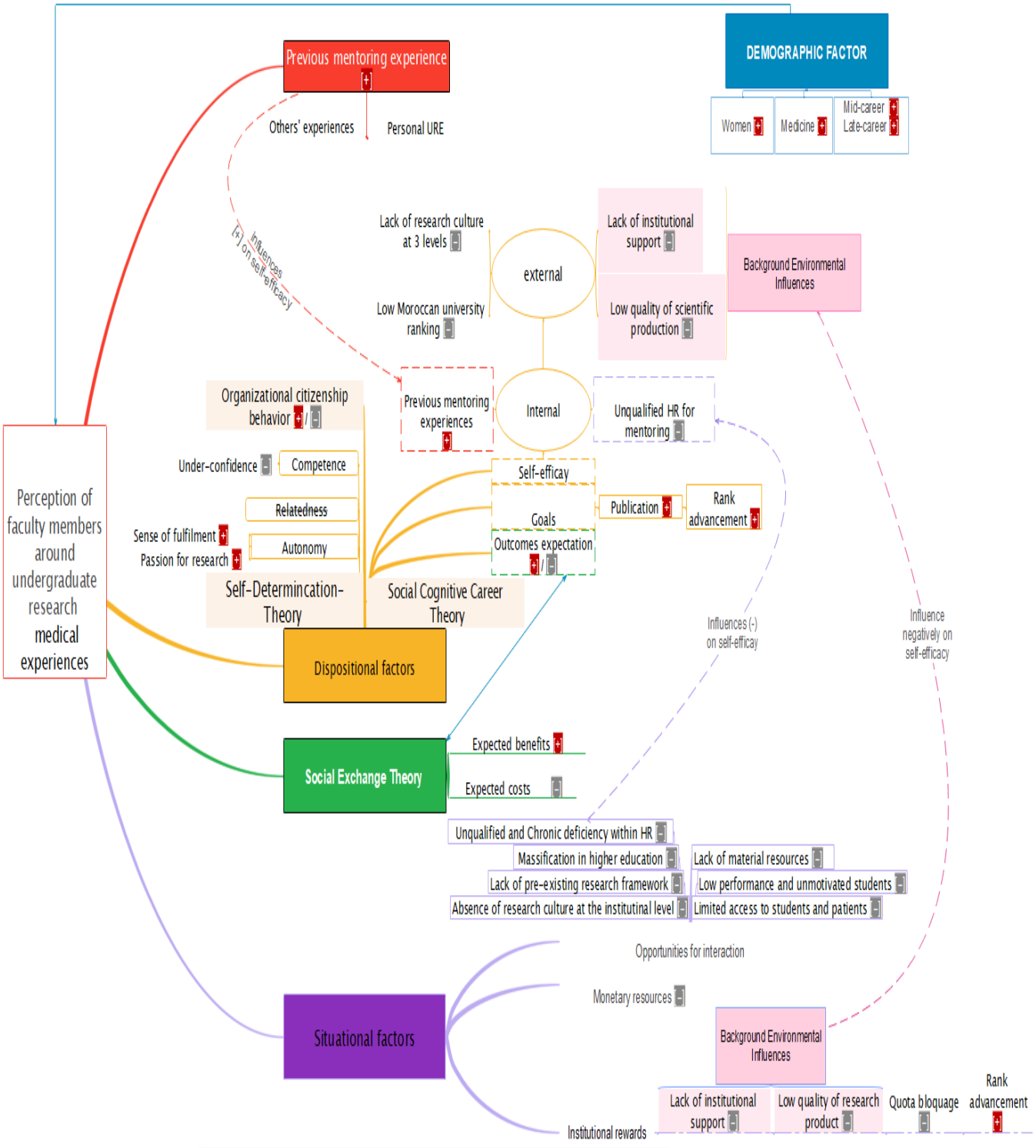


Figure 8: Summary results about perceived challenges and perceived benefits of faculty members about undergraduate medical research, in the faculty of medicine and pharmacy in Marrakesh.

As for the perceived challenges shaping the self-efficacy of faculty members, we note that the current low quality of research output and the low institutional support, which were classified as situational factors, had a negative impact on self-efficacy, therefore on the perception of faculty members about undergraduate medical research. The expected outcomes are the anticipated results found in both expected costs and expected benefits. As for goals, both goals -publication and rank advancement- were perceived as benefits.

Regarding the self-determination theory, faculty members expressed their passion in research and the sense of joy and fulfilment while they conduct and accomplish research with undergraduate medical students (autonomy). However, their request in engaging experts from the clinical research center and the lack of qualification among some faculty members were perceived as challenges (Competent). No result emerged in relatedness.

Discussion of main results

Morocco is a middle-income country, situated in the North of the African continent. The medical curriculum in Morocco is supported by the public and private sectors, and ensures six-year medical education where undergraduates can access the 1st year right after Baccalaureate obtention.

Medical universities in Morocco have undergone various modifications. One major modification is the duration of the medical curriculum, which has been shortened from 7 years of medical studies to 6 years. Other changes concerning the manual pedagogical content were implemented, yet it resulted in ensuring medical curricula at the nationwide level.

Meanwhile, traditional teaching persisted strongly, supporting a faculty-centered approach(58). These outdated teaching methods in medical universities have been described as inadequate to prepare students for their professional lives, for that purpose, Kuh et al.(25) urged universities to implement at least two “high-impact” activities during the undergraduate level, one in the first year and the other in the last year (59).

Evidence-based medicine practice has become the standard in modern medicine. It relies on evidence extracted from valid research findings and applied in practice, ensuring the effective

translation from bench to-bedside(60). Supporting a customized assessment of each patient based on their clinical displays (37).

In Morocco, medical students are required to conduct research in their final year, which probably represents their sole exposure to research during medical studies in Morocco, unless a faculty member or an undergraduate medical student-initiated research work earlier.

Further, the scientific research output derived from medical theses continues to drop year by year (37). Thesis work was perceived as the final step to the obtention of the M.D, hence medical students didn't put serious effort into their research. This has led to an increased level of plagiarism (61), and repeated medical thesis topics and content with few modifications(62). This is explained by the insufficiency of the thesis supervision in shaping a research background (37).

No structured institutional program has been established in Moroccan medical universities to initiate such exposure at the undergraduate level. which could negatively affect their competencies in planning and conducting research(63,64). Our study was conducted to understand and explore perceptions of faculty members on such initiation, if it were ever to be considered for implementation. Our focus on faculty members' insights could be justified by the limited importance given to faculty members' perceptions, as shown in the literature review.

Conversely, a large body of articles focused on the undergraduate medical students' point of view. To address this gap, our study aims to identify perceptions of faculty members at the Faculty of Medicine and Pharmacy of Marrakesh. We will discuss the authentic results of our study in light of Morales's conceptual framework and relevant findings in the literature review.

I. Socio-demographic characteristics

Female faculty members and male faculty members had equal mentoring experiences. According to the literature review, although female faculty members were seen to be more motivated in engaging through undergraduate research experiences (56), this concordance could be explained by the sampling method in our study. Dalton et al. and Levinson et al.(65,66) indicate that life science disciplines significantly enhance faculty motivation through URE. In our research, faculty

members in medical and surgical departments reported the highest mentoring experiences. These findings align with the existing literature.

As for faculty members in mid-career, they also had the most mentoring research experiences, aligning with our conceptual framework. According to the stage career development, mid-career faculty members are more interested in promotions; therefore, they will engage in activities that are academically recognized to attain academic excellence (65,66). Late-career faculty members also emerged as the most participants who previously mentored undergraduates through research. This could be explained by the fact that they exhibit the most confidence in succeeding in research work, especially with undergraduates' first experience through research (67).

II. Previous mentorship experiences:

Experienced mentors exhibit more confidence in mentoring undergraduate students who have never been engaged in the research process(67). The self-efficacy beliefs are shaped through personal performance accomplishment and similar experiences observed outside their range. Faculty members in our study reported positive research mentoring experiences as well as successful undergraduate research observed in other contexts(68). It could be explained by positive mentoring experiences, which shaped faculty members' own beliefs in succeeding in upcoming mentoring opportunities. We suggest that this could establish a strong foundation to motivate faculty members for upcoming opportunities in undergraduate research experiences.

III. Social exchange theory: Expected costs Versus Expected benefits

1. Expected costs:

Our participants perceived the challenge in managing both schedules of faculty members and undergraduate medical students, to allocate time for research. However, both parties had other priorities that distanced them from engaging in undergraduate medical research. Plus, the absence of a research culture among undergraduates was perceived as a negative impact on the learning journey and the quality of the outcome product. Lastly, faculty members feared losing

centralization of their clinical data by engaging an undergraduate medical student who enrolls in different departments.

Other studies on mentoring undergraduates recognize the lack of time among undergraduates in medical curricula, pharmacy, and other fields. It revealed that undergraduate students are distracted by other assessments, especially non-research activities (23,69–74). Their schedules are bombarded with intensive theoretical coursework, midterm preparations, and exams, in addition to clinical rotations in medical studies. Similarities present across disciplines and countries suggest that the timing challenge is not unique to our context, but is a common perceived concern strongly present in different contexts.

Faculty members tried to rearrange these activities during semester breaks; however, research facilities were closed (75). Others revealed that the brief sessions of course delivery make it unrealistic to involve an undergraduate every time (69). Faculty members' perceptions about the timing challenge didn't concern exclusively undergraduate medical students; faculty members, as well, were unable to dedicate time for undergraduate research activities, which made juggling both schedules more complex (23,69,75–77).

Each faculty member is expected to excel in a triad of clinical activities, teaching, and research work(78). These expectations of academics were also reported by our participants. On top of that, faculty members perceive the mentoring of undergraduate medical research as time-consuming (18,24,49,78–80). Since faculty members' schedules are already overwhelmed with exam preparation and grading, research couldn't fit anywhere(76).

Additionally, other studies have shown that meeting the expected requirements from faculty members is often an unrealistic and impractical goal, even for full-time faculty and those at research-intensive universities(81–90).

We suggest following the U.S.A. supportive strategy and encourage faculty members within medical institutions to allocate 20% of their total workload to service duties. This time management is

suggested to balance faculty schedules, hence prevent their burnout. Ultimately, this will permit innovations and allow new ideas to flow (78).

Regarding research culture among undergraduate medical students, the lack of research culture was perceived as challenging as others. This absence in research culture is supported in a study conducted to explore the perception of undergraduate medical students about the role of faculty members who served them best, through the medical curriculum. The role of "information provider" represents the most responses (91), which reflects a lack of autonomy in building knowledge and a continuous dependence on faculty members to provide information.

Such a mindset is outdated in the 21st century, considering the availability of free and massive information resources (58). Hyper-dependency was also reported by faculty members. We explain it by the strong presence of a faculty-centered teaching approach in Moroccan medical institutions, despite efforts in establishing new reforms.

During clinical rotations, research was off-limits for undergraduate medical students, and institutions focused mainly on clinical practice (92). Plus, undergraduates refer exclusively to faculty members' lectures to excel on their exams (91). This largely contributed to the lack of interest in research among medical students, who associated the absence of undergraduate research within their environment to the uselessness of research in general(93).

2. Expected benefits of the 'Labor':

The social exchange theory outlines a product-centered model of Undergraduate Research Experience (URE). It focuses more on expected benefits in shaping faculty members' perceived benefits towards such "high-impact" activities (38).

One of the main perceived benefits for faculty members was achieving academic excellence through the institutional recognition of undergraduate research manuscripts within their professional portfolios.

Brew et al. study (75) encouraged faculty members to draw realistic outcomes from these experiences, especially that the cultivation of benefits requires time. Arranging both schedules, as previously mentioned, was already seen as a hassle for both undergraduates and faculty members.

Faculty members should bear in mind that their usual research work, but this time with undergraduates, is often undergraduates' first time (75). Which implies that faculty members need to readdress their approach towards a student-centered one and value undergraduates' learning process (26).

This does not indicate that undergraduate medical research is deprived of benefits for faculty members; Multiple studies endorse the results encountered in our study, highlighting the benefits of faculty members through undergraduate research, and specifically undergraduate medical research(75,94,95).

As for hard skills, enhancement in leadership skills, an increase in stimulation, unlocking new research methodology, authorship, improved teaching skills, and polishing their knowledge are all skills reported in the literature review (94,96). Soft skills weren't described in our results; however, studies illustrated URE as a new platform contributing to the personality development of faculty members, especially in terms of skills useful for their interaction within teamwork and especially with undergraduates(69,94).

Communication skills, the ability to adapt to change, patience, and flexibility are all acquired soft skills and valuable for upcoming interactions within undergraduate research experiences (69,94). Faculty members valued undergraduates' contributions to their research project (10,18,23,38,97). Such contributions are highlighted in numerous studies. (6,23,69).

We note: Expanding the literature review, Data entry, writing manuscripts, bringing new insights to the research work, the energy of undergraduates, which created a vibrant ambiance, and undergraduates who processed appropriate questions, which contribute to upgrading the value of research, redirecting the work towards a more impactful area

The accomplishment of these tasks by undergraduate students resulted in the completion of the research work, hence its publication. Sometimes, it even initiated a new research project (98–100).

On top of that, undergraduate research demonstrated an increase in research collaboration(95). Especially with isolated departments 'departments silos', who used undergraduate students as mediators between departments to break this isolation problem. These mediators established an inter-disciplinary partnership, since undergraduate students enroll in different departments(75).

Regarding the results, in our study, faculty members anticipated that previous mentored undergraduate medical students through research would eventually choose to join their departments and work side-by-side within their research project, in alignment with their long-term vision for their research projects.

Findings were similar in the study of Adedokum et al.(23), which reports how two undergraduate students, previously mentored by a faculty member, joined their department. Faculty reported that training became easier. This could be explained by the fact that both faculty and undergraduate were familiarized with each other's methods of working.

Plus, faculty members who demonstrate a high level of competence, clinical teaching abilities, and humanistic characteristics might be seen as role models to undergraduates (91), shaping their physician identity and impacting their residency choice at the graduate level (27,101,102).

IV. Dispositional factors:

1. Organizational citizenship behavior:

William and Anderson. (103) divided the OCB into two main dimensions: the OCBO and OCBI. OCBO: stands for the Organizational Citizenship Behavior Organization. They are behaviors forwarded for the benefit of institutions.

And, OCBI stands for Organizational Citizenship Behavior for Individuals. Directly impacting designated individuals within the organization and indirectly benefiting the organization. This OCBI

consists of five (5) other dimensions: altruism, consciousness, courtesy, sportsmanship, and civic virtue.

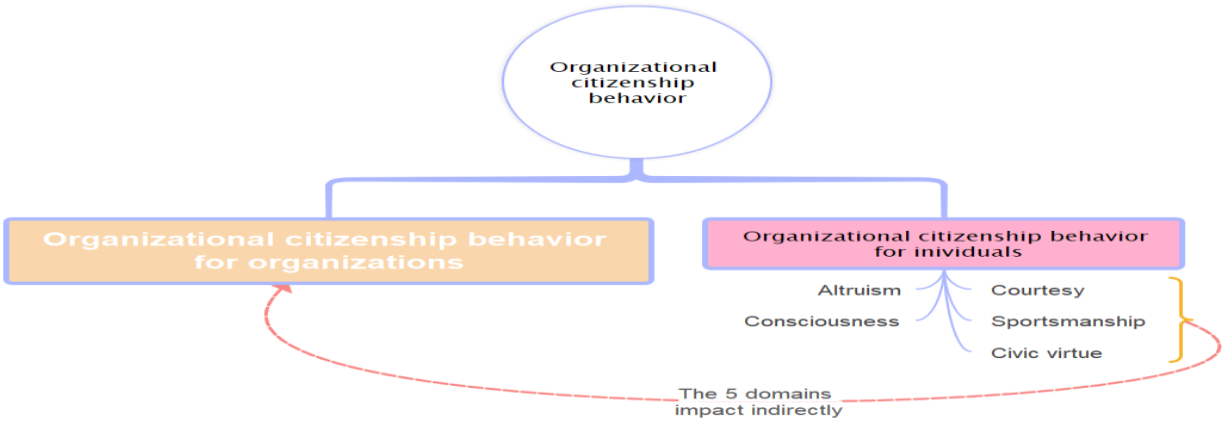


Figure 9: The Organizational Citizenship Behavior Following the model of Williams and Anderson

a. Altruism

In our context, we define altruism as a sense of selflessness demonstrated by faculty members to voluntarily engage in undergraduate medical research without expecting to be rewarded; instead, the main intention is to help undergraduates develop research skills. This classification supports that faculty members perceived their engagement in undergraduate research activities as a devotion of their effort and time to benefit undergraduates, without expecting any personal gain.

Faculty members perceived that medical students who will be involved in undergraduate research will become more open to new academic opportunities, previously ignored or unknown. At the graduate level, a research career could be chosen or a residency program abroad. The study by Segal et al. demonstrated that 37% of those who performed research during undergraduate medical studies were engaged in postgraduate research, compared to 22% who didn't participate in undergraduate research but still pursued research at the postgraduate level (104). The impact of previous undergraduate research exposure on academic career pursuit can be explained by the fact that undergraduate students become familiar with the theoretical translation of knowledge to the practical side. Eventually, this bond promotes the pursuit of academic and research careers.(13,14,105–107).

- **OCBO: Benefits for the society**

Results of our study revealed that the advancement of faculty research work, the acquisition of the Evidence-Based-Medicine practice, and both students' contributions and faculty members' contributions to the undergraduate medical research could effectively improve health promotion, increase innovation in the medical field, alongside the number of collaborative publications.

A study conducted within a pharmacy university revealed similar impacts. Undergraduate research experiences positively influence some aspects of the healthcare system and maybe even some policies in the country (69). Another aspect to improve healthcare access is the influence of undergraduate research exposure on post-graduate career choice, especially in research(104,107). Ultimately, this can promote an effective solution to the recent decline in the number of scientist-researchers (108).

- **OCBO: Benefits for medical institution**

In our study, undergraduate medical research was perceived as a way to increase medical institutions' credibility and reputation by increasing the medical scientific research output, which would also result in enhancing the institution's visibility.

When undergraduate medical research results in its publication, undoubtedly, the publication rate in the institution will increase. In the long term, the overall scientific research output of the institution will improve in terms of quantity and quality(92), and the medical curriculum will become more credible and stronger.

Similarly, the College of Pharmacy at Qatar University (CPH-QA) successfully received the Canadian accreditation, after intensive efforts in implementing undergraduate research into pharmacy studies. The research application was one of the key conditions in secruing the Canadian accreditation (69). And universities enhance their visibility through these multiple published research papers (17).

b. Consciousness

Disparities are observed in the literature review, as some perceive undergraduate research as an extra trouble added to the crowded academic schedule of both undergraduates and faculty members(109). While others believe that a research background is vital in preparing undergraduate students for practice(69)

In our study, faculty members' responses weren't on the same page. Some believed that research has become a must-required skill in the 21st century. Meanwhile, one participant described research integration during undergraduate medical studies as useless for their clinical practice.

Health is defined by the World Health Organization (WHO) as "a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity"(110). To facilitate the definition of roles to a general practitioner, WONCA (World Organization of National Colleges, Academies and Academic Associations of General Practitioners/Family Physicians) described 5 principles a frontline health professional must demonstrate: CARE PROVIDER, DECISION MAKER, COMMUNICATOR, COMMUNITY LEADER, and MANAGER.

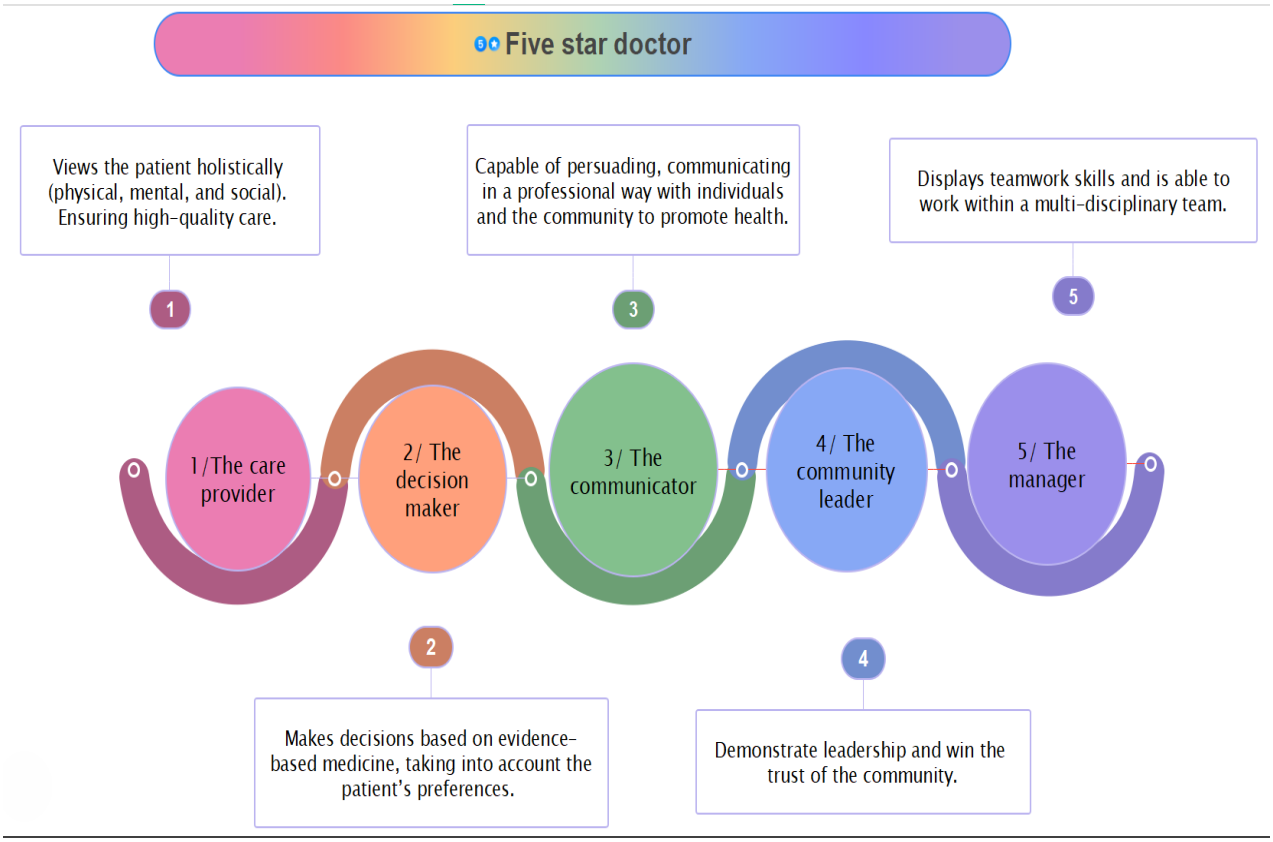


Figure 10:The five-star doctor, WONCA

Research engagement since the undergraduate level shapes a strong foundation that could help future general practitioners in their daily clinical practice. Evidence-based medicine practice has become important to update one's knowledge in order to keep up with medical updates, due to the changing character of diseases (11).

Regarding our results, faculty members reported that engaging undergraduates in research is part of the academic mission. Similarities were observed in multiple quantitative and qualitative studies on faculty motivation, reporting their commitment to teaching missions, and that research is a part of it(17,111,112).

Faculty members diversified the learning process of research by helping undergraduate students through oral communications and posters, to enhance their competencies and be better prepared for graduate studies. Harden and Crosby (113) described roles assigned to instructors to facilitate the comprehension of their new roles in contemporary higher education. These roles are described

as follows: information provider, role model, facilitator, assessor, planner, and resource material developer.

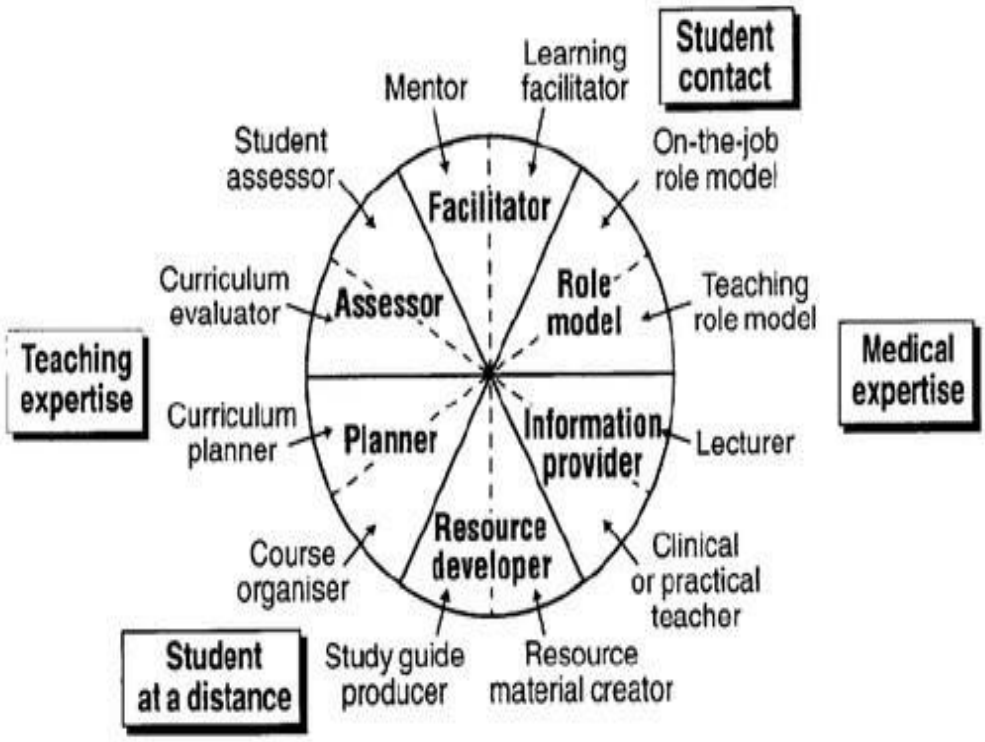


Figure 11: Roles of the teacher following Harden and Cross

Faculty members described research as another moment of teaching. This promotes a student-centered approach among faculty members of medical universities, where students are actively engaged in the learning process rather than passively receiving knowledge through traditional lectures(26,114).

Merging research and teaching has become the standard in contemporary higher education (115). Faculty assigns undergraduate students research tasks, they must accomplish(4,17,26). Gradually, undergraduates become autonomous in work, confident, and capable of handling larger tasks and confronting problems. Despite the multiple forms of undergraduates' engagement in research (75), and the desire expressed by academics in bringing both research and teaching closer, institutions lacked conceptualization of strategies and real application to sustain such valued approach(116).

c. Courtesy

Faculty members stated that it was unfair to engage undergraduate medical students in research without rewarding them with some form of reward. Faculty members' desire to reward and recognize undergraduates' exceptional effort aligns with the courtesy concept. This act of recognition will make undergraduates feel seen and enhance the relationship between undergraduates and faculty members. (68)

These recognition forms can motivate undergraduate medical students to pursue research, especially when they find interest in a particular reward. For instance, medical students pursue research at the undergraduate level to publish an article with their names listed, and endorse their applications for graduate studies in medical universities abroad (117).

d. Sportsmanship

The Moroccan research context has its shortcomings (inadequate infrastructure, lacking tools). Even so, faculty members believed that undergraduate medical research could still be carried out. However, they perceived what hindered their engagement was their lack of reflex to involve medical students, while they were present in their department.

These perceptions supported sportsmanship by accepting the occurrence of unverified incidents within undergraduate medical research. Also, embracing errors and disparities in students' performance levels is another aspect of sportsmanship. And even a novice medical student is worth faculty members' time and mentoring through undergraduate medical research(94,116).

Regarding the lack of research culture among faculty members reported in our study. Institutions are responsible for shaping such a mindset, rather than integrating more research-based courses and redirecting the educational system towards a student-centered approach(91). However, medical education continues to cultivate knowledge-consumption students. And traditional lecture delivery remained strong(58).

e. Civic virtue

Reported responses align with the definition of civic virtue; faculty members could actively participate in undergraduate research as they perceived it could positively impact the healthcare system. Faculty members perceived themselves as citizens inside a community. Faculty members' engagement in undergraduate research could lead to authentic results, for instance, the development of a new drug or the discovery of a new disease. All these contributions promote civic virtues.

Even when individuals who engage, at first for pure self-interest, might develop or make a realization of civic virtues. Therefore, we suppose that faculty members might intend these virtues from the beginning, or in another scenario, the authentic results obtained through undergraduate medical research could develop civic virtues that could promote upcoming undergraduate research(118).

We map out these action effects in the figure below.

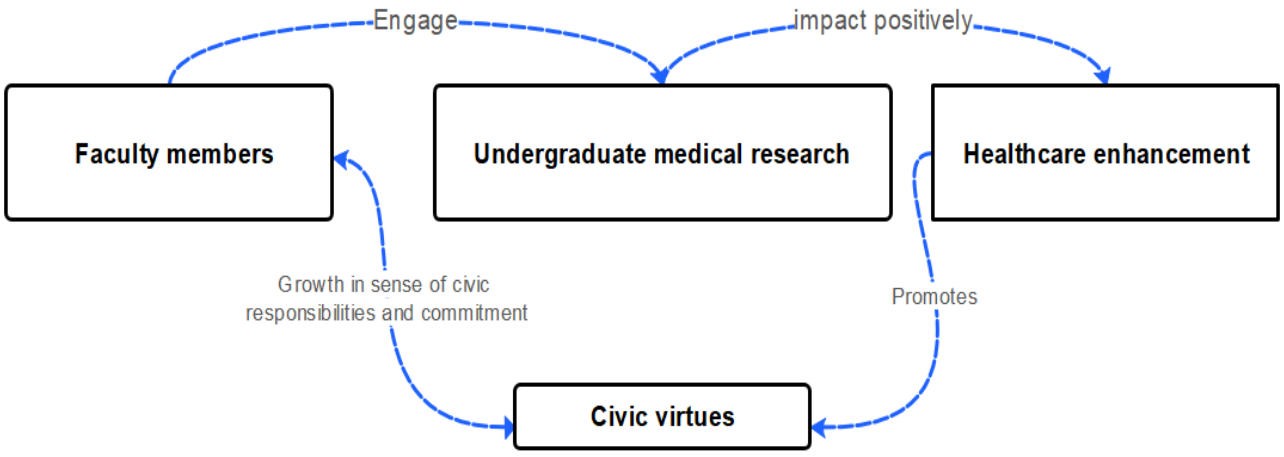


Figure 12:Promotion of civic virtues within undergraduate medical research

2. Social cognitive career theory

We chose the social cognitive career theory to explain how faculty members make educational and career choices, as mentoring is linked to job satisfaction in their careers. The social cognitive career theory, or the SCCT, is a behavioral theory that can explain academic performance. It is crafted around three interconnected variables: (self-efficacy) and (expected outcomes). Both factors impact one another and shape whether faculty members choose to engage or abstain. When faculty members choose to engage, it is to achieve a personal goal (68,119).

In short, self-efficacy beliefs revolve around dynamic factors; we mention previous mentoring experience (e.g., personal performance and vicarious experience), failure or success in these previous experiences impact one's belief in their self-efficacy. Other external factors (social persuasion) also have a direct impact on self-efficacy(68).

In our study, we suppose that faculty members who reported previous mentoring experiences have a strong belief in their self-efficacy. However, other constraints may outweigh this positive impact. We note perceptions of their qualifications, and four other external factors that are interconnected: absence of the research culture at the institutional level, among faculty members, and undergraduates, lack of institutional research support, low rankings in medical institutions, and lastly, low quality of research output.

In Morocco, the medical theses publication rate over 11 years (2011-2021) is about 0.8%. This reflects a large gap in medical thesis publication compared to other countries, like Turkey (11,9) (35), France (17%)(120) , and Tunisia (13,4%)(121).

The low number of articles published in English and the language barrier in our educational system can explain the low rate of publications. Out of 83 published theses, only 5 are originally written in English; besides, 42 are translated into English after the thesis defense(37). Plus, if medical institutions value medical theses, they should prioritize publications, which will motivate faculty members to take more interest in mentoring medical students. Consequently, this will enhance research quality and increase publication rate(122).

This can be aligned to undergraduate medical research; Therefore, institutions need to value such early exposure by implementing research among young medical students. For this purpose, Institutions are required to accommodate their strategies to benefit the professional development of faculty members according to their needs, especially with early career faculty members. (123).

Faculty members anticipated outcomes, which were the same as results showcased in the social exchange theory, where faculty members expected both negative and positive outcomes. This demonstrates that all perceptions of faculty members, even if it does seem separated, it significantly influences one another.

And lastly, faculty members attain the desired promotion by accomplishing undergraduate research, which will result in publication, and this publication will contribute to their advancement.

3. Self-determination theory

Self-determination theory is a broader theory to understand human behaviors. It implies that individuals, faculty members in our study, are motivated when their engagement is derived from self-willingness (autonomous), if they feel competent(competence), and connected to others (relatedness)(124).

We assume that in our study, faculty members felt both competent and autonomous. Faculty members reported feeling wholesome when they accomplished a research culture, and especially with medical students. However, feeling the need to be supported by the center of research in the university hospital reflected a doubt in their own competence.

Faculty members reported a sense of autonomy that enhanced further creativity in research conduct with undergraduates, when the university system gave faculty more freedom in ways to conduct undergraduate research(17). They also felt satisfied witnessing the personal and professional development of their undergraduates, and enjoyed the learning process alongside writing them letters of recommendation, as if they had achieved it(23,38,75).

These emotional dimensions positively impact faculty members to initiate further undergraduate research(23). In our context, faculty members can be the ones to initiate and increase the engagement of undergraduates through medical research. Controversially, faculty members felt incompetent in front of novice undergraduate medical students.

Faculty members perceived difficulty in making undergraduates familiar with what is unfamiliar to them (e.g., data analysis, writing scientifically)(23), plus they recognized their flaws in mentoring young medical students in research. Therefore, they suggested delegating the mentoring mission and the supervision to experts from the clinical research center, who they considered to be more qualified in undergraduate medical research mentoring, and maybe even for faculty members to have someone to turn to when needed.

V. Situational factors

There is a lack of financial reward policies in Moroccan medical universities. Faculty members' sole reward was the progression in ranks. It's when faculty members increase their scientific research output, alongside other academic duties. Faculty members needed time to research to achieve academic excellence. However, they are absorbed by teaching and departmental activities.

It is seen that institutions deliberately set up faculty members for failure when they don't support faculty research development. This lack of support consists of not clearing up the workload of faculty members; instead, they prioritize other academic deadlines, and consider research work as 'me time', when faculty can finally dedicate time out of their schedule to conduct research(78).

Moreover, if medical universities provide incentives for engaging undergraduate medical students through research, faculty members will definitely take an interest in it (47).

Regarding situational factors related to undergraduate medical students, faculty members perceived the underperformance of undergraduate medical students, massification, and the limited access to undergraduates as challenges that could mitigate the initiation of such opportunities, or they might impact the quality of the research work.

Undergraduates are expected to have a strong theoretical research foundation to facilitate the task for faculty members through undergraduate research experiences. Others explained that the theoretical knowledge is not sufficient (38,79), and that undergraduates need to undergo their first research in order to gain experience and enhance their performance for upcoming undergraduate involvement in research (69).

A medical student's research performance is not exclusively assessed by previous research experiences, hence the number of publications. Sometimes, a low research performance can reflect a low level of genuine research interest. For instance, when competitiveness rises among medical resident doctors in dermatology, this often leads to an inflation in research output in terms of quantity. And these publications fail to reach the standard of a peer-reviewed article(125).

The Moroccan research system requires activation and reinforcement in monitoring research quality, by discouraging poor research methodology, incorrect analyses, and plagiarism. This can lead to many research disqualifications. However, this approach fosters and supports meaningful engagement with fewer impactful research studies, over an irrelevant increase in research output.

To claim such culture, the system is required to implement research early at the undergraduate level, alongside a research committee to monitor research quality. In that way, undergraduates will become gradually familiar with the research process, learn to conduct correct methodology, and evaluate the research results. Overall, undergraduates will be able to conduct correct research.

Research conduct is a complex process, therefore, communication skills, flexibility, and emotional intelligence are qualities faculty members reported as important among undergraduates(69). However, offering every undergraduate student the privilege to participate in undergraduate medical research is perceived as challenging, given the large numbers of medical students enrolling each year in medical studies, in the face of the shortage of faculty members(17,37,75).

Therefore, the assessment of undergraduate medical students' performance in research is related to the objectives put in the first place. In some cases, faculty members focus on the broader development of the undergraduate, including their research skills. And in other cases, faculty won't

label undergraduate learning as research until the final product reaches a certain quality. Especially with the replication of research topics and content, which do not contribute to any advancement(75).

Regarding perceived challenges among human resources. Results showed that faculty members acknowledged their shortcomings in mentoring undergraduates through research. Therefore, they recommended that institutions offer ongoing training programs to improve mentoring skills. A strong research background is considered the basic foundation to transfer knowledge from a veteran (faculty member) to a novice (undergraduate medical student) (126). However, academics overestimated themselves, and when professional development meetings were held for their benefit, no one participated. Their overconfidence can itself explain their lack of qualifications(75).

It is essential to note that faculty members' qualifications aren't limited to research skills. Management and interpersonal skills, among others, are essential to facilitate the conduct of research under a collaborative environment to enhance the learning process outcomes(91,127,128).

This a summary of some skills found in the literature in the figure below.(69,91,129)

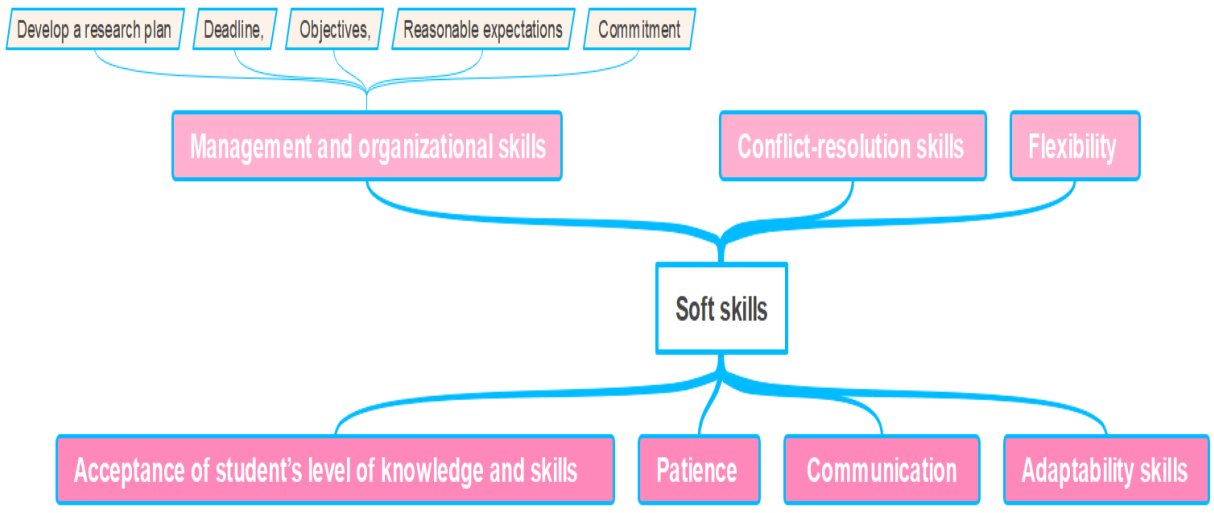


Figure 13: Required Soft skills to mentor undergraduate medical students

As for the chronic deficiency in human resources, it was perceived as a limitation in upcoming engagement in undergraduate medical research. The overloaded academic schedule of faculty members can explain their need for more staff. And easing some academic missions can free up space for research, and relieve temporarily this chronic deficiency in human resources(17).

Plus, at our faculty of Medicine and Pharmacy of Marrakesh, there are 346 faculty members versus 3850 medical students, this number covers medical students from the pre-clinical cycle (first and second year), and clinical cycle from third year to students who are still working on their medical thesis. Adding the number of resident doctors (1163), this could strengthen the number of mentors, thereby faculty members could engage resident doctors in the mentoring process, which could ease some of the burden, and final drafts sent to faculty members are previously monitored by resident doctors.

This mentoring dynamic can therefore be switched from a one-on-one mentoring model (mentoring forward), and faculty members can start engaging graduate and postgraduate students through the mentoring process. This labeled 'mentoring forward' model creates a collaborative research environment where undergraduates can find someone to communicate with on a regular basis (94). At intensive-research universities, most mentors are graduate students or postdoctoral researchers(130,131)

During the COVID-19 pandemic, Moroccan medical institutions used E-learning platforms to continue delivering knowledge. This could be a good starting point to implement distance learning on a nationwide scale. As a result, other active learning activities could be integrated and promote a student-centered educational approach (58).

As regards institutions lacking material resources, lacking a pre-existing research framework, and lacking a research culture. Similarities were found in the literature when faculty members also reported their need for a 'staff-room' and the lack of effort in fostering research culture among medical students and academics, including faculty members(109,116,132).

In other contexts, even when undergraduate research culture existed, efforts were uncoordinated. Therefore, the presence of an undergraduate research building is with a potential vital importance to organize and coordinate all efforts and strategies and make undergraduate research practical and effective (75).

In Morocco, the educational system still focuses on clinical practice and maintains a faculty-centered approach (58). To build a research culture in a non-research-intensive university, the core mission of the university should shift towards faculty research development. Such transformation requires the presence of a supportive academic who conceptualizes strategic initiatives, organizes seminars and consultations, also secures funds for the research; efforts that support and contribute to faculty research development(75).

Limitations and strengths of this study:

We acknowledge some limitations in our study to should be taken into consideration. During the data analysis, some statements were difficult to grasp, which could result in losing some meanings that were misunderstood by the research team. This could only be explained by the 'Epistemic Asymmetry', which is the gap in expertise between the investigator's background and

Qualitative study conducted by our research team was a first, but results in or study aren't meant to be generalized to all medical faculty's body.

This study is the first in Morocco to discuss undergraduate research experiences among faculty members in the medical curriculum. The qualitative design of the current study explored deeply Faculty members' perceptions regarding the undergraduate medical research. The findings of our qualitative study raised awareness around undergraduate medical research. Notably, the strategies of implementation summarized in our study could serve as a strong starting point to establish a trial undergraduate research program and test its effectiveness and feasibility. More importantly, faculty members' perceptions could be taken into consideration by supporting and promoting what motivates them, and resolving problems related to their workload and qualifications for a better mentoring experience.

Recommendations:

The purpose of our study is to shed light on perceptions of faculty members about a highly recommended undergraduate experience: the undergraduate medical research. These experiences are absent in Moroccan medical curricula, thereby we wanted to explore different challenges and benefits perceived by faculty members, to examine the practical side and resurface faculty members' motivation towards such activities for. The following are some recommendations for :

I. Faculty members:

1. Spreading awareness among undergraduate medical students, during clinical enrolment or during the theoretical courses.

When faculty members frequently discuss research topics in front of undergraduates and allow them to see its presence across different departments at the university hospital, this can help reinforce the idea among undergraduate medical students that research exists and is active in nearly every department. Additionally, discussing research whenever faculty members have the opportunity will make undergraduates believe in its importance and foster curiosity, which could inspire them to take the initiative and pursue research experiences with their chosen faculty members.

2. Small tasks for undergraduate medical students

Begin by involving undergraduate medical students early, during their internship enrollment in active research departments. Faculty can assign undergraduates tasks such as distributing questionnaires, reviewing clinical files in archives, entering data into software, or at least observing and assisting to familiarize them with the research process.

3. Engage undergraduate student in research-based courses

Some suggestions among faculty members included organizing a research introductory course as one of the activities during the internship. In most departments, resident doctors are required to discuss articles as part of their training. Faculty members can encourage their

undergraduate medical students to assist with these research-based courses, and at some point, ask undergraduates to bring articles, discuss the study hypothesis, the methodology used, and the findings. Securing funds under current circumstances might be difficult or impossible.

II. For the institutions:

4. Online applications:

Recruit undergraduate medical students as research assistants and help faculty who are struggling to meet deadlines due to other academic responsibilities. This could benefit both parties: undergraduates gain exposure to research, and faculty members advance their agenda.

For this purpose, and in collaboration with faculty members in need, institutions can display lists of applications online targeting undergraduate medical students who are interested in taking part in a research project.

5. Research assistants:

Recruit undergraduate medical students as research assistants and help faculty who are struggling to meet deadlines due to other academic responsibilities. This could benefit both parties: undergraduates gain exposure to research, and faculty members advance their research work.

6. Recognition:

Institutions, alongside faculty members, are required to reward undergraduates' engagement in undergraduate medical research by submitting their names among other authors' on the published article. Other forms of recognition can be used: certificates, gadgets to encourage them for further engagement in research work.

Rewards could differ, but authorship is the most desirable and strong form of recognition for undergraduate medical students.

7. Support the thesis committee:

Reinforce the monitoring of medical thesis content and quality of research work, in order to prevent fatal errors and plagiarism. The committee needs to start refusing medical thesis that contain fatal errors, and rectify with research team mistakes conducted in methodology step or results generation.

Encourage original research and genuine scientific contributions within the medical faculty by rewarding non-repetitive research topics, and with high-quality scientific methodology and writing, free from fatal errors and plagiarism.

8. E-courses:

Relay on pre-recorded online courses to free up faculty members' academic schedules, like the case during the COVID-19 pandemic. These pre-recorded courses can replace the lectures delivered at the faculty. Held online or face-to-face meetings to discuss ambiguous parts that were hard to understand by undergraduate medical students.

9. Summer program

Organize summer co-curricular undergraduate research experience, especially for students who have finished their exams, during the period that starts with June until July, or even at August.

III. Trial undergraduate medical research experience

Conceptualize an undergraduate medical research project that could engage a small number of medical students, select undergraduate students and faculty members who are highly motivated to take part in this new initiative.

Include in meetings faculty members who are going to serve as mentors. Academics faculty members can collaboratively develop the trial research plan: suggest research topics, develop research courses to nurture undergraduates with a sufficient research background before entering the practical aspect, list the assigned pedagogical tasks, set deadlines, frequency of meetings and set the objectives.

Make of this trial a subject of study, a qualitative or a qualitative quantitative type and follow academics, faculty members and undergraduates' feedback to evaluate the success of this trial.

IV. Upcoming studies:

- Explore perceptions of other faculty members from private and public universities other than Marrakesh. Since our study was a qualitative study, to explore deeply faculty members' beliefs around undergraduate medical research. Therefore, the focus was not to generalize the findings.
- Conduct a survey on faculty members in the Faculty of Medicine and Pharmacy of Marrakesh to measure their motivation for the trial undergraduate medical research.
- Our study included faculty members' perceptions, as part of a large research project that include undergraduate medical students and faculty members. It is worth to note that medical resident doctors play an essential role in the hierarchical system in Morocco. Usually, medical students' manuscripts and drafts won't reach faculty members unless a resident doctor has reviewed them previously. Highlighting the important role of these individuals in supervising medical students and facilitating the task of mentorship for faculty members.

Conclusion

In conclusion, undergraduate research experiences are viewed as an important activity within the medical curriculum. And efforts should match the faculty members' enthusiasm about engaging undergraduate medical students, especially in structured models. Our study is the first to raise discussions on these high-impact educational research experiences among faculty members belonging to the medical faculty body. This study followed the increasing wave of undergraduate medical experiences, in which both faculty members and medical students started to take an interest.

Faculty members, in our study, acknowledged the undergraduate medical research benefits on a large scale. Starting from themselves, by gaining knowledge and unlock new skills through the mentoring experiences. Undergraduate medical students also develop numerous skills valuable in the short and long term. These benefits extend to the society as a whole by enhancing the patient assessment and closing the gap in healthcare access. Medical institutions also got their part of benefits; the medical institution's reputation got enhanced and its credibility increased following the scientific research output explosion as consequence of high-quality mentoring undergraduate medical research experiences, especially when institutional support is placed correctly.

To sum up, there's always a room for great optimism. Plus, our work put forward several recommendations that could serve as a solid foundation to establish and develop some undergraduate medical research programs. It also opens doors to other studies that could cover faculty members from various Moroccan medical universities, or even other dynamic, including medical resident doctors that could serve also as mentors and lunch a triad relationship study: faculty member-medical resident doctor-undergraduate medical students.

ABSTRACT

Abstract

Background:

In Morocco, medical curricula do not offer undergraduate medical students any exposure to medical research before their medical thesis, which is essential for the professional development of future general practitioners. Numerous studies highlight the benefits and challenges faced by undergraduate medical students through their participation in undergraduate medical research. Conversely, few articles are interested in faculty members' perceptions.

Objectives:

The objectives of this study were to explore faculty members' perceptions regarding Undergraduate Medical Research Experiences (UMRE) in the Faculty of Medicine and Pharmacy of Marrakesh and to analyze their motivations towards Undergraduate Medical Research Experiences.

Methods:

We conducted a qualitative study to explore perceptions of faculty members from the Faculty of Medicine and Pharmacy of Marrakesh. A non-probabilistic sampling method was used to select diversified profiles. Interviews were face-to-face, mostly individual, with one dyadic interview. Data collection took place from June 25th 2024, to July 24th 2024. All interviews were recorded, transcribed, and coded. A thematic content analysis was conducted by two investigators manually, based on a hypothetico-deductive approach.

Results:

Twenty-two faculty members participated in the interviews. Female faculty members had equal mentoring experiences as male faculty members. Mid-career (13,6%), late-career faculty members (72,7%), and medical fields faculty members reported at least one undergraduate mentoring experience. Previous mentoring experiences could either personal mentoring or observed outside their departments, were a positive motivation for faculty members.

Situational challenges included limited patient and undergraduate access in some departments, massification versus a chronic deficiency in human resources, absence of institutional support, and a lack of research culture. In addition, monetary resources were absent, and no reward policy was present in the Moroccan educational system except for academic rank progression.

The expected costs and benefits were based on the social exchange theory. They included the professional growth of faculty members and collaborative partnerships, as well as mentoring for succession. In contrast, faculty reported difficulty managing their schedules alongside undergraduates' and anticipated lack of research culture among undergraduates.

Dispositional factors concerned the personal interest, attitudes, and personality traits toward undergraduate medical research. We used self-determination and social cognitive career theories to explain the intrinsic motivations of faculty members. Those theories were related to the organizational Citizenship behavior. Only the under confidence of faculty members negatively influenced their motivation.

Faculty members contributed to the professional development of undergraduate medical students. Indirectly, society and medical institutions had a positive impact on their motivation (altruism). Participants reported a sense of duty within undergraduate medical research (consciousness). The

shortcomings in the current situation were trivial excuses (sportsmanship). Authorship and other rewards for undergraduate medical students were essential (courtesy). Faculty members engaged in undergraduate research to improve the community's healthcare (civic virtue).

Conclusion:

To summarize, our study aligns with the increasing interest in undergraduate medical experiences. However, many perceived challenges could hinder its implementation. Therefore, efforts should be united to reinforce the existing benefits and establish strategies to promote such valuable engagement.

Keywords:

Faculty members, Undergraduate medical research, Undergraduate medical students, perceptions, Faculty of Medicine and Pharmacy of Marrakesh.

Résumé

Contexte :

Au Maroc, les études médicales n'exposent les étudiants à la recherche qu'au stade de thèse en médecine. Pourtant, la recherche médicale au cours de formation initiale est essentielle pour le développement professionnel des futurs médecins généralistes. De nombreuses études ont exploré les bénéfices et les obstacles des étudiants en médecine en formation initiale lors de cette recherche médicale. En revanche, peu d'articles s'intéressent aux perceptions des enseignants.

Objectifs :

Les objectifs de cette étude sont d'explorer les perceptions des enseignants envers la recherche médicale au cours de la formation initiale des étudiants en médecine, dans la faculté de médecine et de pharmacie de Marrakech, et d'analyser leur motivation envers ce genre d'initiation.

Méthodes :

L'étude est qualitative et a ciblé les enseignants de la faculté de médecine et de pharmacie de Marrakech. L'échantillonnage était non-probabiliste afin de sélectionner des profils diversifiés. Les entretiens ont été menés en présentiel, tous étaient individuels, à l'exception d'un seul entretien dyadique (à deux). La collection des données s'est étalée du 25 Juin 2024 jusqu'à le 24 Juillet 2024. Tous les entretiens ont été enregistrés, retranscrits et codés. L'analyse thématique du contenu a été effectuée manuellement et menée par deux investigateurs en suivant une approche hypothético-déductive.

Résultats :

Vingt-deux enseignants ont participé aux entretiens. Les enseignants du sexe féminin ont rapporté le même nombre d'expérience en mentorat de recherche que ceux du sexe masculin. Les enseignants en milieu de carrière (13,6%), en fin de carrière (72,7%), et ceux qui appartiennent au corps médicinal ont rapporté tous, au moins, une expérience du mentorat de recherche en médecine au cours de formation initiale. Ces expériences, que ça soit personnelles ou observées d'autre part, ont un impact positif sur la motivation des enseignants.

Les barrières situationnelles relevaient d'un accès restreint aux patients et aux étudiants de médecine dans certains services, une massification face à un déficit chronique de ressources humaines, l'absence du soutien institutionnel et un manque de culture de recherche. Les ressources financières sont absentes, et aucune politique de récompense dans le système éducatif au Maroc n'existe, en dehors de l'avancement de grade.

La théorie d'échange social inclut des bénéfices et des coûts anticipés. On rapporte un développent professionnel chez les enseignants, l'établissement de collaboration entre les départements dans le cadre de recherche. Par contre, il y'avait une difficulté à retrouver un compromis entre la charge du travail chez les enseignants et les étudiants en formation initiale ainsi qu'un manque de culture de recherche chez les étudiants en formation initiale.

Les facteurs dispositionnels renvoient à des éléments intrinsèques qui justifient les attitudes and les motivations internes des enseignants vis-à-vis cette implication. La théorie d'auto-détermination et socio-cognitive des choix de carrière utilisées pour expliquer ces facteurs

dispositionnels. On note leur impact indirect sur le comportement de citoyenneté organisationnelle. Ainsi, seuls le manque de confiance et l'absence d'une culture de recherche chez les enseignants ont été signalés comme obstacles.
Les enseignants ont contribué au développement professionnel des étudiants en formation initiale. On mentionne un impact positif-indirect sur la société et les facultés de médecine générale (Altruisme). Leur motivation est guidée par une conscience morale envers ces étudiants (conformisme). Une approche positive malgré la présence des défauts décrits comme des futilités (esprit sportif). La paternité scientifique et d'autres formes de récompenses sont essentielles (Courtoisie). Les enseignants participeront dans la recherche au cours de la formation initiale avec une intention de promouvoir la santé communautaire (vertu civique).

Conclusion :

En conclusion, notre étude est conforme à l'intérêt orienté vers cette recherche médical en formation initiale. Toutefois, de nombreuses barrières peuvent entraver sa mise-en œuvre. Il est donc essentiel de renforcer les bénéfices préexistants puis d'établir des stratégies d'intégration adaptées.

Mots-clés :

Les enseignants – Les étudiants de médecine en formation initiale – La recherche médicale au cours de la formation initiale – Perception – La faculté de médecine et de pharmacie de Marrakech.

ملخص

السياق:

لا تتيح المناهج الطبية الحالية لطلبة الطب في المغرب فرصة الانخراط الفعلي في البحث العلمي إلا قبل إعداد أطروحة التخرج، رغم أن هذه التجربة تُعدّ أساسية لتأهيلهم المهني كأطباء عامّين مستقبليين. وقد أبرزت العديد من الدراسات اراء الطلبة تجاه هذه التجربة. في المقابل، لم يتم التركيز بشكل كبير على تصوّرات أعضاء هيئة التدريس بشأن هذا الموضوع.

الأهداف:

تهدف هذه الدراسة إلى الإطلاع على تصوّرات أعضاء هيئة التدريس في كلية الطب والصيدلة بمراكش حول البحث الطبي خلال دراسة السلك الأول، وتحليل دوافعهم للمشاركة في تأطير هذا النوع من الأبحاث.

المنهجية:

ارتكزت الدراسة على مقاربة نوعية، و استخدمت المعاينة غير الاحتمالية في اختيار مجموعة متنوعة من المشاركين. أُجريت المقابلات بشكل حضوري، معظمها فردية باستثناء مقابلة ثنائية واحدة. امتدت فترة المقابلات منذ 25 يونيو إلى 24 يوليوز 2024. وقد تم التسجيل الصوتي، و إعادة نسخ وتشفير جميع المقابلات، ثم تحليلها موضوعيًا و يطريقة يدويّة من قبل باحثَيْن باستخدام المنهج الافتراضي-الاستنتاجي.

النتائج:

شارك اثنان و عشرون عضوا من هيئة التدريس. سجلت نفس عدد تأطير هدالبحوث العلمية لدى المنخرطين من الإناث أو الذكور. كما سجلت مشاركة أساتذة في منتصف (,(13,6%) و نهاية المسار المهني (72,7%)، لاسيما المنتمين إلى التخصصات الطبية. و قد أغدفاد المشاركون بأن هذه التجارب السابقة تشكل حافزا إجابيا للانخراط في هذا المجال، سواء كانت هذه التجارب شخصية أو من خلال ملاحظاتهم لتجارب زملاء أخرين.

أما التحديات السياقية فتشمل تواصلا محدودا مع المرضى و طلبة الطب في بعض الأقسام السريرية. نذكر كذلك عدد طلبة الطب الهائل مقابل نقص حاد في صفوف أعضاء هيئة التدريس، زيادة على غياب الدعم المؤسساتي و التمويل المادي لمثل هذه التجارب و غياب كامل لثقافة البحث العلمي خلال دراسة السلك الأول. أما مايتعلق بوسائل التحفيزية لأعضاء هية التدريس، نسجل انعدام سياسة من هذا القبيل باستثناء الترقيات الأكاديمية.

العوامل الذاتية تحدد الاهتمامات و الاختيارات الفردية الخاصة بأعضاء هيئة التدريس. تم الاعتماد على نضريتين لتفسير النتائج المحصل عليها: نظرية التحديد الذاتي و نظرية المسار المهني المعرفية الاجتماعية. كلتا النظريتين تؤثران بشكل إيجابي على سلوك المواطنة التنظيمية.

أبرزت النتائج على أن أعضاء هيئة التدريس قد تساهم في التطوير المهني و الذاتي لطلبة الطب، كما أبرزت تأثيرا إيجابيا على المجتم المدني و كليات الطب (الإيثار). كما ذكر المشاركون إحساسهم بالواجب تجاه تكوين طلبة الطب السلك الأول في البحث العلمي (الامتثال التنظيمي). و اعتبر المشاركون وجود ثغور في النظام الحالي مجرد أذار ثانوية لاتستدعي العزوف عن الخوض في هذا النوع من البحث الطبي(الروح الرياضية). كما اعتبرت نسب التأليف و الصور الأخرى من المكافآت مقابل انخراط طلبة د الطب في البحث العلمي مسألة أساسية(السلوك الحضاري). و قد عبر المشاركون على أن أحساسهم بالمواطنة يحفزهم على تأطير البحث الطبي، من أجل تحسين صحة المواطن(اللواء التنظيمي).

خاتمة:

تتوافق دراستنا مع الاهتمام المتزايد حول هذا النوع من البحوث الطبية الذي تشهده المنظومة الطبية في العالم. إلا أن عددًا من التحديات المحتملة قد تعيق تفعيل هذا التوجه. لذلك، من اللازم تكاتف الجهود لدعم الوضع الحالي والمكتسبات، ووضع استراتيجيات فعالة لتشجيع كل من أعضاء هيئة التدريس والطلبة على الانخراط في البحث العلمي خلال مرحلة الدراسة الأولى.

كلمات المفتاح:

أعضاء هيئة التدريس– البحث في العلوم الطبية – كلية الطب و الصيدلة بمراكش – وجهة نظر-طلبة الطب خلال الدراسة الجامعية.

APPENDICES

APPENDIX 1: The interview guide

Bonjour Professeur,

Je suis Mme. Jihad Sarkadi. Je suis éudiante en instance de thèse à la faculté de médecine générale CADDI AYYAD. Et je fais partie de l'équipe qui mène l'étude sur la perception de nos professeurs à propos de l'implication dans la recherche médicale des étudiants du 1er et 2ème cycle (en formation initiale), appelés en anglais : undergraduate students.

Nous vous remercions d'avoir accepté de participer à cette étude et de consacrer votre temps pour répondre à nos questions.

L'objectif de cette étude est d'explorer les différentes opinions des Professeurs et leur retour envers l'implication des étudiants en médecine du 1er et 2ème cycle dans la recherche médicale, en incluant aussi la perception des Professeurs qui n'ont jamais eu la chance à collaborer avec des étudiants.
Notre objectif ultime est d'encourager ce genre d'expérience dans notre contexte. Et puisque souvent on trouve des études qui explorent le point de vue des étudiants, on a souhaité de mettre en avant celui des Professeurs

Notre étude suit les règles de l'éthique, donc tout ce qui va passer durant cet entretien sera utile pour notre étude et ne sera pas divulgué à aucune personne étrangère à notre équipe d'étude. L'entretien ne va pas porter votre nom no prénom et vos informations vont rester confidentielles. Aussi, les données seront supprimées après la fin de l'exploitation et à n'importe quel moment de cet entretien, vous pouvez y mettre fin.

Je prends votre consentement sur l'enregistrement de votre voix après cette brève introduction. Après la fin de notre réunion, l'enregistrement sera transcrit et analysé par notre équipe.
Avant d'entamer, l'enregistrement avez-vous une question ?

Thèmes :	Questions
1/ Introduction : 2/donnez démographiques :	Permettez-moi de vous poser quelques questions à propos : Discipline (science fondamentale, médecine/chirurgie) Grade (Pr. Assistant, Pr. Agrégé, Pr. De l'éducation supérieure) Ancienneté. Avez-vous déjà impliqué un étudiant du 1er ou 2ème cycle dans un cadre de recherche médicale ? Si oui, dans quel contexte et quel a été l'objet de cette étude ? Quelles seraient les modalités pour intégrer les étudiants en médecine ?
Perception	Maintenant, j'aimerai rentrer dans le vif du sujet ave vous. Que pensez-vous de l'implication des étudiants en médecine en formation initiale dans la recherche médicale ? D'après vous, comment les étudiants en médecine perçoivent l'expérience en recherche médicale ? Au début, au cours et à la fin. Quelles modalités pour ce genre d'activité ? Par exemple : sélection des étudiants évaluation tâches pour les étudiants rôle de l'enseignant. Quels sont les critères de réussite d'une expérience d'implication des étudiants dans la recherche médicale ? Quels sont les facteurs/déterminants, selon vous, qui contribuent au succès de l'implication des étudiants dans l'activité de recherche ?
Les obstacles	Quelles sont les difficultés liées à cette démarche ?
Bénéfices	Que peuvent être les motivations et les bénéfices pour les étudiants ? Quelles motivations et bénéfices pour les enseignants ?
Pistes d'amélioration	Que pensez-vous de la faisabilité dans notre contexte ?

APPENDIX 2 : The informed consent form of our study

Titre du projet :

Perspective des enseignants à propos de l'implication des étudiants de médecine en formation initiale dans la recherche médicale.

Investigateur principal : Pr. Latifa Adarmouch

Institution : Faculté de Médecine et de Pharmacie de Marrakech.

contact : la.adarmouch@uca.ac.ma

Description du projet :

Nous sommes une équipe formée d'un étudiant en instance de thèse Mlle. JIHAD SARKADI et son encadrant
Pr. ADARMOUCH LATIFA, Professeur en médecine communautaire à la FMPM. L'étude que nous amenons, est intitulée : « Perception of a Faculty Members about Undergraduate Medical Research » en français : « Perspective des enseignants à propos de l'implication des étudiants de médecine en formation initiale dans la recherche médicale.»

L'objectif de l'étude est d'explorer les différentes opinions des enseignants par rapport à ce sujet ; y compris leurs perceptions, les bénéfices et les obstacles qui peuvent accompagner ce genre d'initiatives. Les expériences antérieures des enseignants à cet égard seront également discutées. Enfin, suggérer des propositions pour promouvoir l'initiation et l'implication des étudiants dans la recherche.
Le but ultime est d'encourager ce genre d'expérience dans notre contexte marocain afin de promouvoir la recherche en santé et à long terme forger des médecins érudits et sensibles. On trouve souvent les études qui explorent le point de vue des étudiants. On a donc souhaité de mettre en avant celui des Professeurs.

Procédure :
Votre participation est volontaire et votre consentement éclairé est nécessaire. lorsque vous acceptez de participer, vous serez invité à participer à un entretien qui va durer presque 30min. Vous pouvez arrêter votre participation à tout moment. L'entretien sera enregistré (audio) et transcrit par la suite puis analysé par notre équipe.

Le contenu de cet entretien restera confidentiel. Il ne sera pas associé à votre identité et ne sera, en aucun cas, divulgué à une personne étrangère à l'équipe d'étude.

Inconvénients :
Votre participation à cette étude ne porte aucun risque. Vous êtes libre de ne pas répondre à n'importe quelle question qui vous met mal à l'aise.

Bénéfices :
Il n'y a pas des bénéfices directs à votre participation. Cependant, votre participation va contribuer à

mieux comprendre les perspectives des enseignants envers l'implication de leurs étudiants dans la recherche et promouvoir la recherche au Maroc.

Questions et informations supplémentaires :

Si vous avez des questions ou avez besoin de plus d'informations concernant cette étude, veuillez contacter l'investigateur principal.

Adresse e-mail : la.adarmouch@uca.ac.ma

Consentement :

En signant ce formulaire, vous confirmez que vous avez lu et compris les informations ci-dessus, que vous avez eu l'opportunité de poser des questions, et que vous acceptez de participer à cette étude.

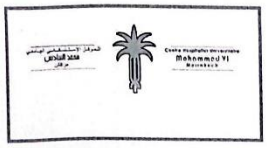
Signature du participant :

Date :

Signature de l'investigateur :

Date :

APPENDIX 3: The approval from the ethical committee



Président:
S. AIT BENALI
Vice président:
D. BOUMZEBRA
Membres :
N. ABOUSSAIR
L. ADARMOUCH
S. AIT BATAHAR
H. ASMOUKI
F. ASRI
M. CHERKAOUI
N. EL ANSARI
M.EL HATTAOUI
K. FOURAIJI
M. KHOUCHANI
N. MANSOURI
S. ZAOUI

Comité d'Éthique
Hospitalo-universitaire de Marrakech

Objet : Décision du Comité sur le protocole soumis

Perspectives des enseignants sur l'implication des étudiants en médecine en formation initiale dans la recherche médicale

N° 105/2024

Investigateurs principaux: Adarmouch Latifa
Sarakadi Jihad

Le comité a reçu votre protocole le 26 juin 2024.

Le Comité a étudié votre protocole le 27 Juin 2024 et les membres ont émis la délibération suivante : **Avis favorable.**

Le comité demande à l'investigateur de rapporter tout incident éventuel survenant lors du déroulement de l'étude et de l'informer sur sa clôture et ses résultats.

Date : 27/06/2024

Signature :

Professeur Said AIT BENALI
Chef de Service de Neurochirurgie
Hôpital Arrazi, CHU Mohammed VI
Marrakech

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قسم الطبيب

أقْسِم بِالله العَظِيم

أن أراقبَ الله في مِهْنَتِي.

وأن أصُونَ حياة الإنسان في كآفّةِ أطوَارهَا في كل الظروف والأحَوال باذلة وسْعِي في انقاذها مِن الهَلاكِ والمرَضِ والألَم والقَلَق.

وأن أحفَظَ لِلنَاسِ كرَامَتهُم، وأسْتر عَوْرَتهُم، وأكتمَ سِرَّهُمْ.

وأن أكونَ عَلى الدوَام من وسائِل رحمة الله، باذلة رعايتي الطبية للقريب والبعيد، للصالح والطالح، والصديق والعدو.

وأن أثابر على طلب العلم، وأسَخِّرَه لِنَفْعِ الإنْسَان لا لأذَاه.

وأن أُوَقّرَ مَن عَلَّمَني، وأُعَلّمَ مَن يَصْغرَني، وأكون أختا لِكُلّ زَميلٍ في المِهنَةِ الطِّبّيَة مُتعَاونِينَ عَلى البرّ والتقوى.

وأن تكون حياتي مِصْدَاق إيمَاني في سِرّي وَعَلانيَتي، نَقِيَّة مِمّا يُشينهَا تجَاهَ الله وَرَسُولِهِ وَالمؤمِنين.

والله على ما أقول شهيد

كليـــــــة الطب
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السنة 2025 الاطروحة رقم 208

وجهة نظر أعضاء هيئة التدريس حول البحث الطبي لدى طلبة الطب خلال الدراسة الجامعية

الأطروحة

قدمت ونوقشت علانية يوم 2025/07/14

من طرف

السيدة.السرقادي جهاد

المزدادة في 29/03/1997 بتزنيت

لنيل شهادة الدكتوراه في الطب

الكلمات المفتاحية

أعضاء هيئة التدريس– البحث في العلوم الطبية – كلية الطب و الصيدلة بمراكش – وجهة نظر– طلبة الطب خلال الدراسة الجامعية.

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